SOUTHERN MAINE COASTAL BASIN

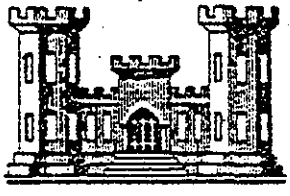
YORK, MAINE

BOULTER DAM

ME 00194

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS

WALTHAM, MASS.

FEBRUARY 1980

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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Southern Miane Coastal Basin
York Maine
Bass Cove Creek

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam consists of an earth embankment with a spillway located at the right end. The length of the dam i about 1045 ft. and its height is about 41 ft. The dam is in good condition. Although sone deficiencies were noted there were no conditions which would warrent urgent remedial action. It is intermediate in size with a hazard potential of significant. The owner should prepare a formal operations and maintenance manual for the dam and establish an emergency preparedness plan and downstream warning system

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SOUTHERN MAINE COASTAL BASIN
YORK, MAINE

[BOULTER DAM, York, Maine...]
ME 00194

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1980

NATIONAL DAM INSPECTION PROGRAM
PHASE I INVESTIGATION REPORT

Identification No.:	ME 00194
Name of Dam:	Boulter
Town:	York
County and State:	York, Maine
Stream:	Bass Cove Creek
Date of Site Visit:	2 November 1979

BRIEF ASSESSMENT

Boulter Dam consists of an earth embankment with a spillway located at the right end. The overall length of the dam is approximately 1,045 ft. and its height is about 41 ft. Boulter Dam was completed in 1950 for the Kittery Water District to form a water supply reservoir on Bass Cove Creek.

Boulter Dam was formerly classified as having a "low" hazard potential in the Corps of Engineers National Inventory of Dams. Due to the extent of downstream development that would be affected in the event the dam were to fail, the dam has been reclassified as having a "significant" hazard potential.

The dam is in good condition, based on a visual examination of the structure. Although some deficiencies were noted, there was no evidence of settlement, lateral movement or signs of structural failure, or other conditions which would warrant urgent remedial action.

Based on the "intermediate" size and "significant" hazard potential classifications, in accordance with Corps of Engineers Guidelines, the adopted test flood for this dam is 1/2 the Probable Maximum Flood (1/2 PMF). With the water level at the top of the dam, the total spillway capacity is approximately 2,530 cfs with no flashboards and 1,830 cfs with 2-ft. high flashboards. Hydraulic analysis indicate the routed test flood outflow, with no flashboards, is 1,100 cfs (inflow 2,400 cfs or 1,050 csm) which can be passed with a freeboard of about 2.3 ft. In addition, the routed test flood outflow with 2 ft. of flashboards is 1,540 cfs, which can be passed with a freeboard of 0.3 ft.

The Kittery Water District, owner of the dam, should engage a registered professional engineer to determine the structural stability of the service bridge, including the bridge abutment, as outlined in Section 7.2. Any

necessary modifications resulting from the investigation, and remedial measures including mowing the grass and weeds on the embankment, removing brush and debris from approach and discharge channels, placing earth fill on the right end of embankment, monitoring flow from the internal drainage system and repairing spalled concrete, as outlined in Section 7.3, should be implemented by the Owner within 2 years after receipt of this report.

The Owner should also prepare a formal operations and maintenance manual for the dam and establish an emergency preparedness plan and downstream warning system.

HALEY & ALDRICH, INC.
by:

Harl Aldrich
President

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I Investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm run-off), or a fraction thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential. Consideration of downstream flooding other than in the event of a dam failure is beyond the scope of this investigation.

The Phase I Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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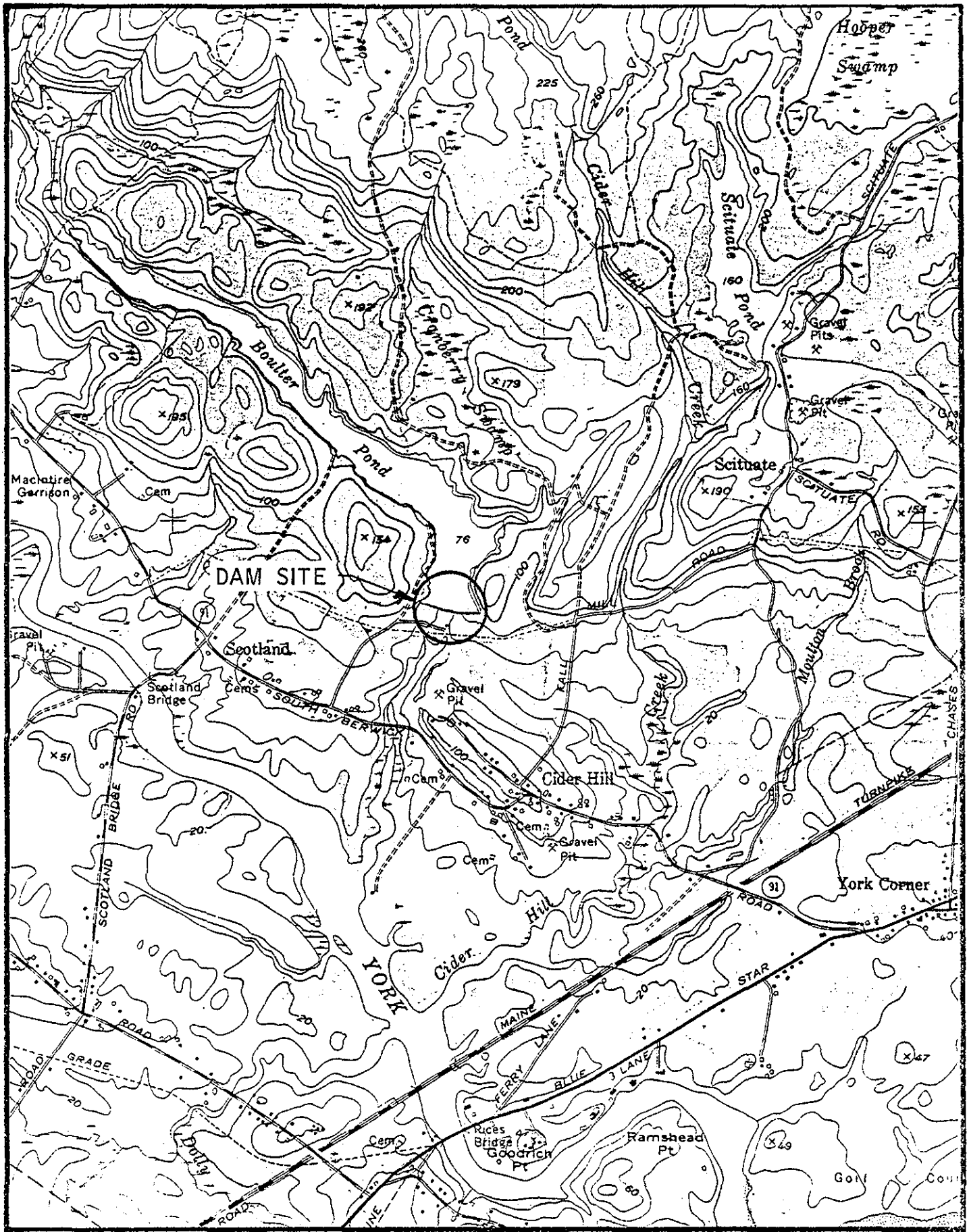
1. Overview of Boulter Dam showing upstream side from left abutment



DAM: Boulter

IDENTIFICATION NO. ME 00194

N

LOCATION MAP

U.S.G.S. QUADRANGLE

YORK HARBOR, ME

APPROX. SCALE: 1" = 2000'

FILE NO. 4454 A 10

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BOULTER DAM
ME 00194

SECTION 1 - PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Haley & Aldrich, Inc. has been retained by the New England Division to inspect and report on selected dams in the States of New Hampshire and Maine. Authorization and notice to proceed were issued to Haley & Aldrich, Inc. under a letter dated 31 October 1979 from Colonel William E. Hodgson, Jr., Corps of Engineers. Contract No. DACW33-80-C-0009 has been assigned by the Corps of Engineers for this work. Camp, Dresser & McKee, Inc. was retained as consultant to Haley & Aldrich, Inc. on the structural, mechanical/electrical and hydraulic/hydrologic aspects of the Investigation.

b. Purpose of Inspection. The primary purposes of the National Dam Inspection Program are to:

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and prepare the states to initiate effective dam safety programs for non-Federal dams.

3. Update, verify and complete the National Inventory of Dams.

1.2 Description of Project

a. Location. Boulter Dam is located at the southern end of the reservoir it forms, Boulter Pond, in the town

and county of York, Maine, as shown on the Location Map, page vii. The latitude and longitude of the dam site are N43°09.8' and W70°41.6'. Spillway discharge is conveyed by Bass Cove Creek approximately 2,400 ft. to a tidal estuary of the York River.

b. Description of Dam and Appurtenances. Boulter Dam consists of an earth embankment with a spillway located at the right end. The overall length of the embankment and spillway is approximately 1,045 ft. The dam's height is about 41 ft. The dam includes a gate structure for water supply intake and a service bridge.

The earth embankment is 930 ft. long with a crest width of 18 ft. and a structural height of 41 ft. The top of the embankment is at El. 80.5. Upstream and downstream slopes are approximately 2 horizontal to 1 vertical. The upstream slope of the embankment is paved with stone riprap and the crest and downstream slope are heavily grassed.

There is a vertical concrete core wall constructed 5 ft. upstream of the centerline of the embankment. The top of the core wall, 2 ft. in width, is about 2.5 ft. lower than the crest elevation of the dam and its maximum section is about 70 ft. high. The core wall is believed to bear on rock. On the downstream side of the core wall an internal drainage system has been provided using 3- to 6-in. stone placed up to 4-ft. thick around a 6-in. diameter concrete pipe. On the left side, the embankment abuts a bedrock surface. On its right, the embankment ends at a concrete training wall that forms the left side of the spillway.

The spillway is a broad crested concrete weir having a total length of 70 ft. The permanent crest of the spillway is at approximately El. 75 and has wooden flashboards, about 2 ft. high, mounted across it. The right side of the spillway abuts an outcropping bedrock surface. The bedrock outcrop rises to the right of the spillway and reaches the top of dam elevation about 45 ft. from the right end of the spillway abutment.

The alignment of the spillway channel directs flow around the right side of the dam in a southerly direction. Approximately 300 ft. downstream of the spillway, the channel crosses under a gravel access road where flow is carried by four 48-in. diameter corrugated metal pipe culverts. The upper end of the discharge channel was formed by excavation in rock.

On the upstream slope approximately 400 ft. left of the spillway training wall is an intake tower. The tower has three gated 16-in. diameter intakes with centerline elevation of 65, 55 and 45, respectively. Water can be conveyed through the dam by two 16-in. diameter pipelines, both at an invert elevation of 41.5. The lowest level that the reservoir can be drawn down to through the low level intake is about El. 44.5.

A 44-ft. long steel service bridge from the upstream edge of the embankment crest provides access to the intake tower. The bridge is supported at one end by the tower and at the other end by a concrete abutment set into the embankment.

Screening and pumping facilities for the Town of Kittery, Maine, water supply system are located on the downstream side of Boulter Dam.

c. Size Classification. The storage to the top of Boulter Dam is estimated to be 2,444 acre-ft., and the corresponding hydraulic height of the dam is approximately 41 ft. Storage of from 1,000 to 50,000 acre-ft. and/or a height of from 40 to 100 ft. classifies this dam in the "intermediate" size category, according to the guidelines established by the Corps of Engineers.

d. Hazard Classification. Boulter Dam was formerly classified as having a "low" hazard potential in the Corps of Engineers National Inventory of Dams. Dam failure analysis computations in Appendix D, which are based on "Guidance for Estimating Downstream Dam Failure Hydrographs", demonstrates why this dam was reclassified as having a "significant" hazard potential. A failure of Boulter Dam would result in the destruction of the intermittently manned water treatment and pumping facilities located immediately downstream of the dam. In addition, marginal flooding of two other structures located approximately 4,400 ft. downstream of the dam would occur.

e. Ownership. The name, address and phone number of the current owner of Boulter Dam is:

Kittery Water District
17 State Road
Kittery, Maine 03904
Phone (207) 439-1128

The Kittery Water District has owned the dam since it was completed in 1950.

f. Operator. Mr. Ed Junkins, Superintendent Kittery Water District, is responsible for operation, maintenance

and safety of the dam. Mr. Junkins has been with the Kittery Water District 22 years and his phone number is (207) 439-1128.

g. Purpose of Dam. The dam was constructed to form a water supply reservoir for the Kittery Water District and has always been used for this purpose.

h. Design and Construction History. Preliminary plans of Boulter Dam and its associated reservoir were developed in 1949 for the Kittery Water District by Whitman & Howard, Engineers, presently of Waltham, Massachusetts. Construction of the dam was undertaken in 1949 by Landers and Griffin, Inc. of Portsmouth, New Hampshire and completed in 1950.

An extended drought and severe water shortage prompted construction to be started within one week of the date that Whitman & Howard, Engineers was retained as the primary consultant to the project. In turn, the details of the dam's configuration were designed as it was built. Additions to the filtration and pumping facilities for the District's water supply system have been constructed over the years. However, no major structural changes to the embankment or spillway have been made since the dam was constructed.

i. Normal Operational Procedures. There is no formal written procedure for the operation of the dam. Water is withdrawn continuously via one 16-in. C.I. pipeline in response to demand by the Kittery Water District which services the Town of Kittery, parts of York and Eliot and the Portsmouth Naval Yard. Reservoir water levels are recorded weekly. The 2 ft. of flashboards are maintained in place year round. The embankment and spillway are visually inspected for defects or abnormal conditions once a month by the operator. In the past, the grass was cut on the embankment on a routine basis. However, this practice was discontinued four years ago and the grass has not been cut since that time.

1.3 Pertinent Data

All elevations reported herein refer to the as-built elevations presented in an article from the July 1950 issue of the Journal of the Maine Water Utilities Association entitled "New Boulter Dam and Reservoir" by Paul F. Howard. The datum for elevation is the National Geodetic Vertical Datum (NGVD).

a. Drainage Area. The drainage area tributary to the

dam site is 2.3 square miles. The watershed is completely undeveloped, heavily forested, and under the control of the Kittery Water District. The terrain is moderately rolling with substantial upstream swamps.

b. Discharge at Dam Site

1. Outlet works	40 cfs at normal pool (El. 77.0)
2. Maximum known flood at dam site	Unknown
3. Ungated spillway capacity at top of dam	
(without flashboards)	2,530 cfs
(with flashboards)	1,830 cfs
4. Ungated spillway capacity at test flood pool elevation	
(without flashboards)	1,100 cfs at El. 78.2
(with flashboards)	1,540 cfs at El. 80.2
5. Gated spillway capacity at normal pool elevation	Not applicable
6. Gated spillway capacity at flood pool elevation	Not applicable
7. Total spillway capacity at test flood pool elevation	
(without flashboards)	1,100 cfs at El. 78.2
(with flashboards)	1,540 cfs at El. 80.2
8. Total project discharge at test flood pool elevation	
(without flashboards)	1,100 cfs
(with flashboards)	1,540 cfs

c. Elevation (ft. above NGVD)

1. Streambed at centerline of dam	39.5
2. Test flood tailwater	76.6 (within discharge channel)
3. Upstream portal invert diversion tunnel	Not applicable
4. Normal pool	77.0
5. Full flood control pool	Not applicable
6. Spillway crest	
(without flashboards)	75.0
(with flashboards)	77.0
7. Design surcharge - original design	Unknown
8. Top of dam	80.5
9. Test flood surcharge	
(without flashboards)	78.2
(with flashboards)	80.2

d. Reservoir

1. Length of test flood pool...	2.8 mi. (Est.)
2. Length of normal pool.....	1.6 mi. (Est.)
3. Length of flood control pool.....	Not applicable

e. Storage (acre-ft.)

1. Normal pool.....	1,995
2. Flood control pool.....	Not applicable
3. Spillway crest.....	1,535
4. Top of dam.....	2,444
5. Test flood pool	
(without flashboards).....	2,145
(with flashboards).....	2,405

f. Reservoir Surface (acres)

1. Normal pool.....	120
2. Flood control pool.....	Not applicable
3. Spillway crest.....	105
4. Top of dam.....	137
5. Test flood pool	
(without flashboards).....	126
(with flashboards).....	135

g. Dam

1. Type.....	Earth embankment
2. Length.....	Approx. 1,045 ft. overall
3. Height.....	41 ft.
4. Top width of embankment.....	18 ft.
5. Side slopes.....	2H to 1V both U/S and D/S
6. Zoning.....	U/S and D/S shells compacted pervious soil
7. Impervious core.....	Concrete core wall to roc
8. Cutoff.....	Concrete core wall to roc
9. Grout curtain.....	12 in. center to center and 12 ft. deep under core wall
10. Other.....	Internal drainage system on D/S side of core wall

h. Diversion and Regulating Tunnel. Not applicable

i. Spillway

1. Type.....	Broad crested 7 ft. wide concrete weir with 2 ft. of flashboards

2. Length of weir.....	70 ft.
3. Crest elevation.....	75.0
4. Gates.....	None (flashboards are a maximum of 2 ft. in height)
5. U/S channel.....	Boulter Pond
6. D/S channel.....	Trapezoidal channel of varying width. Min. width is 30 ft., slope is 0.068
7. General.....	90 percent of the width of the spillway discharge channel is ledge; the remaining 10 percent is a concrete slab

j. Regulating Outlets. The reservoir drain is one of the two 16-in. C.I. pipelines that is gated at the reservoir intake tower. Although the invert elevation of the drain is El. 41.5, as it leaves the intake tower, the lowest level that the reservoir can be drawn down to is El. 44.5 which is the invert elevation of the low level 16-in. diameter intake. The drain pipeline is connected to a manhole at the toe of the dam followed by a second manhole (open pit) into which surface drainage conduits are also connected. From this pit, the 16-in. pipeline continues to Bass Cove Creek.

SECTION 2 - ENGINEERING DATA

2.1 Design Data

An executed copy of the contract and specifications dated 2 December 1949 and titled "Contract for Building Dam, Clearing Reservoir, etc., Kittery Water District, Kittery, Maine", was obtained from the archives of Whitman & Howard, Inc. Included with the contract specifications were four drawings, three of which are presented in Appendix B. The contract document and associated drawings comprise all the available design data known to exist on Boulter Dam.

2.2 Construction Data

Photographs showing the original construction of Boulter Dam can be viewed at the offices of the Kittery Water District. An article from the July 1950 Journal of the Maine Water Utilities Association by Paul F. Howard, "New Boulter Dam and Reservoir", describes the construction of the dam and gives as-built information. In particular, the article notes as-constructed elevations of the embankment, core wall, spillway and associated appurtenant structures. A copy of the article is included in Appendix B.

The Kittery Water District's photograph collection and the Maine Water Utilities Association article are the only available construction data known to exist.

2.3 Operation Data

No operational data, other than reservoir levels and water usage records, were located. The intake tower was reportedly dewatered and inspected two years ago.

2.4 Evaluation of Data

a. Availablity. A list of the engineering data available for use in preparing this report is included on page B-1. Selected documents from the listing are also included in Appendix B.

b. Adequacy. There was a considerable amount of engineering data available to aid in the evaluation of Boulter Dam. A review of these data in combination with visual

examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement, was adequate for the purpose of a Phase I assessment.

c. Validity. The information contained in the engineering data may generally be considered valid. However, details on the drawings are shown as designed and may vary from those actually built. For example, the spillway was constructed on the right side of the embankment and not the left; also the top width was found to be 18 ft., not 30 ft. as shown on the 1949 Whitman & Howard drawings or 22 ft. as given in the Maine Water Utilities Association article. In general, there is about a 2 ft. elevation difference between the original drawings and the paper by Paul E. Howard, the later source considered to be valid.

SECTION 3 - VISUAL EXAMINATION

3.1 Findings

a. General. The Phase I visual examination of Boulter Dam was conducted on 2 November 1979. The upstream water surface elevation was measured 13.5 ft. below the top of the intake tower (8.5 ft. below the spillway weir) that day or about El. 66.5.

In general, the project was found to be in good condition. Several minor deficiencies which require correction were noted.

A visual inspection check list is included in Appendix A and selected photographs of the project are given in Appendix C. A "Site Plan Sketch", page C-1, shows the direction of view for each photograph.

b. Dam. The earth embankment is generally in good to excellent condition. The stone riprap paving on the upstream slope consists of a layer of cobbles and boulders with some broken rock varying from 4 in. to 3 ft. in nominal size, Photo No. 2. Grass, weeds and other vegetation are growing in the riprap along the top 6 ft. of the embankment. The stone riprap beneath the service bridge appears to project out, about 1 foot, perpendicular to the slope over a distance of about 30 ft., Photo No. 3. It is probable that the embankment was constructed with this configuration.

The grass and vegetation along the crest of the embankment are low and in some areas the crest has been worn bare, probably by two-wheeled or other vehicle traffic. The crest on the right side, Photo No. 4, is 6 to 12 in. lower than the adjacent concrete training wall and appears to be generally lower than the crest elevation of the dam within about 20 ft. of the wall. Overall, the vertical alignment of the embankment crest is good and the horizontal alignment is curved as designed.

The downstream slope of the embankment is covered with tall grass and weeds as shown on Photo No. 5. No seepage or low wet areas were apparent, but the reservoir level was low the day of the visual examination, at about El. 66.5, which is approximately 8.5 ft. below the permanent spillway crest. No animal burrows were noted in the embankment; however, the thick vegetation did make the downstream slope difficult to examine. A set of 1-ft.

wide stone steps is located on the downstream slope about 100 ft. left of the intake tower service bridge, Photo No. 6. A well worn path located adjacent to the steps and another further to the right, Photo No. 5, both appear to have been made by motorbikes.

During the site examination, the location of the 6-in. diameter outlet for the internal drainage system could not be located. Subsequently, the Superintendent of the Kittery Water District stated that the internal drainage system connects to the 16-in. C.I. pipeline that serves as a reservoir drain. Several catch basins have been added to the site for surface drainage since the original construction of the facility. The 16-in. reservoir drain outlets at a 6-ft. deep broken stone-lined pit with two CMP conduits and cast iron pipes leading to it. The pit is located approximately 180 ft. from the downstream toe of the dam, Photo No. 7, and has a noticeable rust brown residue in it.

c. Appurtenant Structures. The spillway is in generally good condition. The concrete portion of the weir has spalled, Photo No. 8, as has the concrete slab adjacent to the toe of the left training wall.

The spillway approach and discharge channels have some vegetation in the form of brush present as shown in Photo No. 9. This photo also shows the presence of debris in the form of stumps in the approach channel. Some mature tree growth is present to the right of the discharge channel.

Approximately 200 ft. downstream of the spillway there are several water-filled depressions. Water is flowing from one of the depressions at an estimated rate of less than 1 gpm. Minor seepage is also occurring in the rock further downstream. Downstream of the access roadway there are five steps constructed at about 30 ft. intervals to minimize scour and erosion of the channel. The steps are formed by a line of 2-in. diameter steel pipes driven to hold a shallow wall of broken rock, Photo No. 10.

The intake tower is in good condition as shown in Photo No. 11. The operator of the dam was not present at the time of the inspection, and in turn, the service gates were not operated. A steel service bridge spans approximately 44 ft. from the dam crest to the intake tower as shown in Photo No. 12. The trusses are seated on bearings

on concrete at both sides. Overall, the bridge is in good condition, though the abutment to the service bridge has moved. This displacement appears to be a downslope translation of the top of the bridge abutment either by a tilting of the abutment pier and footing or structural distress in the abutment pier. This may or may not have been caused by settlement. There is some cracking and spalling at the base of the abutment and some cracking is present at the backwall of the bridge seat, Photo No. 13.

d. Reservoir Area. Boulter Pond is bordered by undeveloped, heavily forested rolling terrain. The pond is long and narrow, having a length of about 8,500 ft. and an average width of only about 500 ft. There is no significant probability of landslides into the reservoir which could effect the safety of the dam. No conditions have been noted which could result in a sudden increase in sedimentation load into the reservoir.

e. Downstream Channel. Bass Cove Creek conveys flows from the spillway discharge channel approximately 2,400 ft. to its confluence with the tidal portion of the York River. Approximately 300 ft. upstream of the confluence is the 20-ft. high Route 91 roadway embankment with a 6.5-ft. high by 6.0-ft. wide box culvert. The spillway discharge channel's invert consists of ledge and has an average slope of 0.068 for the first 220 ft. downstream of the spillway weir.

3.2 Evaluation

Based on the visual examination conducted on 2 November 1979, the earth embankment of Boulter Dam is considered to be in good condition. The spillway and intake tower appear to be in generally good condition and performing satisfactorily at the present time. Only minor deficiencies were noted for these appurtenant structures. No condition was observed that would adversely effect the safety of the dam.

It should be noted that the operation of the service gates on the intake tower was not demonstrated and that the reservoir water surface was at a low elevation the day of the site examination.

Remedial measures as outlined in Section 7.3 should be implemented to correct the noted deficiencies in the spillway channel, intake tower service bridge and downstream slope of the earth embankment.

SECTION 4 - OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

a. General. In general, there are no formal procedures for the operation of Boulter Dam. Two feet of flashboards are maintained on the spillway weir year round. The intake tower service gates are operated as needed to withdraw water as required by the Owner.

b. Description of any Warning System in Effect. There is no warning system or emergency preparedness plan in effect for this structure.

4.2 Maintenance Procedures

a. General. There are no established procedures or manuals for inspection and maintenance of the dam. The dam is visually checked by the operator for abnormal conditions once each month. Remedial measures such as the cutting of grass was reportedly discontinued four years ago. However, grass at the crest of the dam appeared short as if recently cut, and there was a general absence of brush on the downstream slope when viewed during the site examination.

b. Operating Facilities. The spillway structure does not appear to have regular maintenance. There is no formal plan to maintain the flashboards or reservoir outlets and to keep the spillway approach and discharge channels free of vegetation and debris. The drain was reportedly opened two years ago, but its operation was not demonstrated during the site visit as the operator of the dam was not present.

4.3 Evaluation

Maintenance of the facility is being performed on the basis of need. There is currently no formal operation or maintenance procedures in effect for Boulter Dam. Formal written operational procedures, maintenance programs, warning system and emergency preparedness plans should be established.

SECTION 5 - EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

The Boulter Dam is a water supply reservoir dam consisting of a 930 ft. long earth embankment with a concrete core wall and a 70 ft. wide spillway with provisions for 2 ft. of flashboards. The dam and reservoir are basically a high surcharge - low spillage facility. Approximately 90 percent of the width of the spillway apron is exposed ledge and the remaining 10 percent consists of a concrete slab. The portion of the reservoir which forms the approach to the spillway is primarily ledge and is nearly flat. The spillway discharge channel has a slope of 0.068 between the 7-ft. wide concrete weir and the four 48-in. diameter CMP culverts beneath the gravel access road located approximately 220 ft. downstream of the weir. The watershed consists of undeveloped, heavily forested terrain which is drained by numerous small brooks having considerable swamps and marsh. The shape of Boulter Pond is long and narrow having a length of about 8,500 ft. and an average width of only about 500 ft.

5.2 Design Data

The only available hydraulic/hydrologic design data located was the following statement in the paper "New Boulter Dam and Reservoir" by Paul F. Howard printed in the July 1950 issue of the Journal of the Maine Water Utilities Association:

> The spillway has a capacity of 2,500 cu. ft. per second. This will take care of the maximum one hour rain fall along the New England coast plus melting snow. The extra storage above the spillway will take care of a storm of twice the record one hour storm, thus giving a quite large factor of safety.

5.3 Experience Data

There are no records of any major hydrological occurances at Boulter Dam. According to the Owner, the reservoir fills to top of flashboards each spring. The dam has never been overtopped.

5.4 Test Flood Analysis

Based on Corps of Engineers Guidelines, the recommended test flood range for the size "intermediate" and hazard potential "significant" is the 1/2 PMF to PMF (Probable Maximum Flood). The 1/2 PMF was selected for the test flood as the size of the facility places it near the low end of the classification range. The PMF was determined using the Corps of Engineers Guidelines for "Estimating Maximum Probable Discharge" in Phase I Dam Safety Investigations. The 2.3 square mile drainage area con-

sists of rolling terrain with considerable swamps and marsh. A peak inflow rate of 2,100 csm was selected for the PMF inflow which results in a test flood inflow (1/2 PMF) of 2,400 cfs.

Surcharge storage routing of the test flood inflow was performed for two conditions: with and without flashboards. This analysis resulted in a routed test flood outflow of 1,100 cfs at a test flood stage of elevation 78.2 with no flashboards and 1,540 cfs at stage elevation 80.2 with 2 ft. of flashboards. Since the top of dam is at elevation 80.5, the spillway is considered adequate to pass the test flood either with or without flashboards.

5.5 Dam Failure Analysis

Based on the Corps of Engineers Guidelines for Estimating Dam Failure Hydrographs, and assuming that a failure would occur along 40 percent of the mid-height length of the dam with pond level at top of dam, the peak failure outflow is estimated to be 58,300 cfs in addition to the 2,500 cfs spillway discharge occurring prior to failure. As a result of a dam failure, the water treatment plant and pumping station, both intermittently manned, located at the toe of the dam would be destroyed. Route 91, located about 2,100 ft. downstream of the dam, would be overtopped by about 11 ft. of water. Two dwellings located near the end of the dam failure impact area on the left bank of the tidal portion of the York River would also be affected.

The potential loss of life resulting from a dam failure is a few and the dam is accordingly classified in the "significant" hazard category.

SECTION 6 - EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observations

There was no visual evidence of settlement, lateral movement or other signs of structural instability in the earth embankment or spillway. Both appeared to be performing satisfactorily under static loading conditions.

A noticeable bulge occurs in the upstream slope beneath the service bridge. However, it is probable that the embankment was constructed with this configuration. The abutment to the service bridge has moved as described in Section 3.1c. This condition places the structural stability of the service bridge abutment in question.

6.2 Design and Construction Data

Design plans dated October 1949 and contract specifications signed 2 December 1949 for the proposed construction of the dam were located. However, the construction contract was awarded based on incomplete plans due to the urgency for construction.

Specifications for the gradation and method of compaction of the earth fill were not stated in specific terms in the contract document. The material to be used was generally defined in the contract as follows:

> The pervious earth fill shall be free of loam, organic matter, trees, brush, roots, stumps and other debris and shall not contain an excessive quantity of clay. The pervious earth fill for dam shall be of the nature of a good binding run of the pit road gravel with sufficient fine material of the proper quality to make it bind well.

The fill was to be placed in 12-in. lifts and undergo a compaction effort of 400 pounds per square foot.

Since geotechnical information on the gradation of the fill and the as-placed density could not be located, a conventional stability analysis of the structure is not feasible. Based on the visual examination of the earth embankment, it is considered stable and should remain so as long as the core wall and internal drainage system perform satisfactorily.

Design plans for the spillway were not included in the contract documents but were probably issued during the construction. Detailed spillway plans could not be located during the Phase I investigation.

6.3 Post-Construction Changes

There have been no known material modifications to the Boulter Dam since its original construction in 1950.

6.4 Seismic Stability

Boulter Dam is located in a Seismic Zone 2 and in accordance with recommended Phase I guidelines does not warrant seismic analysis.

SECTION 7 - ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. The visual examination of the earth embankment and structural portions of Boulter Dam revealed that the dam was in good condition. Although there were no signs of impending structural failure or other conditions which would warrant urgent remedial action, minor structural deficiencies were noted at the service bridge, including the bridge abutment.

Based on the results of computations included in Appendix D and described in Section 5, the spillway is capable of passing the test flood, which for this structure is the 1/2 PMF, without overtopping the dam. With the water level at the top of the dam, the total spillway capacity is approximately 2,530 cfs with no flashboards and 1,830 cfs with 2 ft. of flashboards. The routed test flood outflow with no flashboards is 1,100 cfs (inflow of 2,400 cfs or 1,050 csm) which can be passed with a freeboard of 2.3 ft. In addition, the routed test flood outflow with 2 ft. of flashboards is 1,540 cfs. This flow can be passed with a freeboard of 0.3 ft.

b. Adequacy of Information. This evaluation of the dam is based primarily on visual examination, preliminary hydraulic and hydrologic computations, consideration of past performance and application of engineering judgement. Generally, the information available or obtained was adequate for the purposes of a Phase I assessment. However, it is recommended that additional information regarding the structural stability of the service bridge, as outlined in Section 7.2, be obtained.

c. Urgency. The recommendation for an additional investigation and remedial measures outlined in Sections 7.2 and 7.3, respectively, should be undertaken by the Owner and completed within two years after receipt of this report.

7.2 Recommendations

Although it does not have a bearing on the safety of the dam, it is recommended that the Owner of the dam engage a registered professional engineer to undertake the following

investigation:

1. Investigate the structural stability of the service bridge, including the bridge abutment.

The Owner should then implement corrective measures on the basis of this engineering evaluation.

7.3 Remedial Measures

Although the visible portions of the earth embankment, spillway and intake tower are generally in good condition, it is considered important that the following items be accomplished.

a. Operation and Maintenance Procedures. The following should be undertaken by the Owner of the dam in addition to the investigation outlined in Section 7.2 to correct deficiencies noted during the visual examination:

1. Mow grass and weeds on the embankment at least once a year.

2. Remove uprooted stumps and debris from spillway approach channel.

3. Clear brush, trees and debris in the spillway discharge channel. Cut the two approximately 12-in. diameter pine trees in the extreme right edge of the discharge channel located within about 50 ft. of the spillway.

4. Place earth fill on the right end of the embankment adjacent to the spillway training wall to restore the embankment to intended grade.

5. Repair the spalled areas of the spillway weir and toe of the left spillway training wall.

6. Repair the cracked and spalled areas of the service bridge abutment; realignment inclusive.

7. Develop a system for monitoring flow out of the internal drainage system such that it may be correlated with reservoir water surface elevation.

8. Examine the dam at a time when the reservoir level is high. Particular attention should be given to the downstream side and any indications of seepage.

9. Operate the gate mechanisms in the intake tower to insure their operability. In addition, a procedure should be established to operate the gate mechanisms periodically.

10. Prepare an operations and maintenance manual for the dam. The manual should include provisions for biennial technical inspection of the dam and round-the-clock surveillance of the dam during periods of heavy precipitation and high discharge. The procedures should delineate the routine operational procedures and maintenance work to be done on the dam to ensure safe, satisfactory operation and to minimize deterioration of the facility.

11. Develop a written emergency preparedness plan and warning system to be used in the event of impending failure of the dam or other emergency conditions. The plan should be developed in cooperation with local officials and downstream inhabitants.

7.4 Alternatives

There are no recommended alternatives.

APPENDIX A - INSPECTION CHECK LIST

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VISUAL INSPECTION PARTY ORGANIZATION	A-1
VISUAL INSPECTION CHECK LIST	
Dam Embankment	A-2
Outlet Works - Spillway Weir, Approach and Discharge Channels	A-3
Outlet Works - Intake Channel and Intake Structure	A-4
Outlet Works - Intake Tower	A-4
Outlet Works - Service Bridge	A-4

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

Dam: Boulter

Date: 2 November 1979

Time: 1300 to 1515

Weather: Clear with moderate temperatures (60° to 65°F)

Water Surface Elevation Upstream: 66.5 (NGVD) (8.5 ft. below top of concrete spillway weir)

Stream Flow: None

Inspection Party:

Harl P. Aldrich, Jr. Charles R. Nickerson Haley & Aldrich, Inc.	- Soils/Geology
Joseph E. Downing	- Hydraulic/Hydrologic
Francis Lutazzi Camp, Dresser & McKee, Inc.	- Structural/Mechanical

Present During Inspection:

No representatives of the Owner or State

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Boulter DATE: 2 Nov 79

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	El. 80.5 (NGVD)
Current Pool Elevation	El. 66.5 (NGVD)
Maximum Impoundment to Date	Unknown
Surface Cracks	None observed
Pavement Condition	No pavement - top of dam is mowed grass
Movement or Settlement of Crest	None evident; however crest elevation within 20 ft. of spillway is 6 to 12 in. below top of concrete wall
Lateral Movement	None observed
Vertical Alignment	Generally good except as noted above
Horizontal Alignment	Curved
Condition at Abutments and at Concrete Structures	Satisfactory
Indications of Movement of Structural Items on Slopes	Abutment foundation of service bridge has tilted upstream about 2 in. at the top
Trespassing on Slopes	Unrestricted; frequent motorbike traffic
Animal Burrows in Embankments	None observed
Vegetation on Embankment	Upstream slope weeds along top 5 ft. (vertical) of slope. Downstream slope generally heavy grass and weeds kneehigh. No trees on slopes
Sloughing or Erosion of Slopes or Abutments	No sloughing noted. Minor erosion along motorbike pathways
Rock Slope Protection - Riprap Failures	Upstream slope blanketed with cobbles and boulders, some broken rock; generally good condition (see text)
Unusual Movement or Cracking at or near Toes	None observed
Unusual Embankment or Downstream Seepage	None observed
Piping or Boils	None observed
Foundation Drainage Features	Six inch concrete pipe with 3-to 6-in. stone around it along downstream face of the core wall; outlet into pit approximately 180 ft. downstream of dam

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Boulter DATE: 2 Nov 79

AREA EVALUATED	CONDITION
Toe Drains	None
Instrumentation Systems	None known to exist
OUTLET WORKS - SPILLWAY WEIR APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	Satisfactory
Loose Rock Overhanging Channel	Not applicable
Trees Overhanging Channel	None observed
Floor of Approach Channel	Minor brush covering bedrock floor of channel. Some stumps and wood debris present
b. Weir and Training Walls	
General Condition of Concrete	Good
Rust or Staining	Minor rust staining at weir crest from steel flashboard supports
Spalling	Spalling present at weir crest
Any Visible Reinforcing	None
Any Seepage or Efflorescence	None
Drain Holes	None noted
c. Discharge Channel	
General Condition	Fair
Loose Rock Overhanging Channel	Not applicable
Trees Overhanging Channel	Several trees present inside channel along the right embankment
Floor of Channel	Channel cut in bedrock; irregular rock bottom with considerable broken rock; channel floor covered with low brush and weeds; two 12-in. diameter pine trees on right side of channel approximately 50 ft. downstream of concrete portion of channel floor

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Boulter DATE: 2 Nov 79

AREA EVALUATED	CONDITION
Other Obstructions	Downstream of gravel access roadway there are 5 hydraulic steps (see text)
OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE	
a. Approach Channel	Not applicable - Intake Tower in reservoir. See "Outlet Works-Spillway Weir, Approach and Discharge Channels"
b. Intake Structure	See "Outlet Works-Intake Tower"
OUTLET WORKS - INTAKE TOWER	Note: Intake Tower in reservoir; access by structural steel service bridge
a. Concrete and Structural	
General Condition	Good
Condition of Joints	Good
Spalling	Minor spalling at bridge seats
Visible Reinforcing	None
Rusting or Staining of Concrete	Minor rust staining at railing posts
Any Seepage or Efflorescence	None observed
Joint Alignment	Good
Unusual Seepage or Leaks in Gate Chamber	Not observable - Operator of dam was not present at time of inspection and gate chamber was not opened
Cracks	None observed
Rusting or Corrosion of Steel	None noted
OUTLET WORKS - SERVICE BRIDGE	Note: Bridge design employs inverted Pratt Trusses bearing on concrete seats with provisions for expansion

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Boulter DATE: 2 Nov 79

AREA EVALUATED	CONDITION
a. Super Structure	
Bearings	Good. Minor rusting of plates present
Anchor Bolts	Two 3/4" bolts at each seat. Bolts at left U/S and D/S bridge seats bent in the D/S direction
Bridge Seat	Good. Minor spalling present
Longitudinal Members	Good
Under Side of Deck	Good
Secondary Bracing	Good
Deck	Good
Drainage System	None
Railings	Good. Minor rusting and peeling of paint present
Expansion Joints	See "Note" above
Paint	Minor peeling present
b. Abutment and Piers	
General Condition of Concrete	Good at Intake Tower. Fair at D/S abutment. Cracking and spalling present at base of D/S abutment
Alignment of Abutment	Tilting of D/S abutment in the U/S direction noted. Tilt was approx. 1-1/2 in. to 2 in. over the exposed height of the abutment
Approach to Bridge	Dam crest - good
Condition of Seat and Backwall	U/S seat in good condition. Cracking is present at the backwall of the D/S seat
c. Mechanical and Electrical	
Air Vents	None observed
Float Wells	None observed
Crane Hoist	None
Elevator	None
Hydraulic System	None
Service Gates	Five manual gate operators present at top of intake tower. Gates were not operated at time of inspection

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Boulter DATE: 2 Nov 79

AREA EVALUATED	CONDITION
Lightning Protection System	None
Emergency Power System	None known
Wiring and Lighting System in Gate Chamber	None known

APPENDIX B - ENGINEERING DATA

	Page
LIST OF AVAILABLE DATA	B-1
PRIOR INSPECTION REPORTS	
None available	
DRAWINGS	
"Site Plan, Proposed Dam, Kittery Water District, Kittery, Maine", Whitman & Howard, Engineers, October 1949	B-9
"Proposed Dam, Profile & Section, Kittery Water District, Kittery, Maine", Whitman & Howard, Engineers, October 1949	B-10
"Proposed Dam, Intake Tower, Drains, Etc., Kittery Water District, Kittery, Maine", Whitman & Howard, Engineers, October 1949	B-11

LIST OF AVAILABLE DATA
BOULTER DAM

Document	Contents	Location
"Contract for Building Dam, Clearing Reservoir, etc.; Kittery Water District; Kittery, Maine"	Contract specifications prepared by Whitman & Howard, Engineers, dated October 1949	Whitman & Howard, Inc. 45 Williams Street Wellesley, MA 02181
"New Boulter Dam and Reservoir" by Paul F. Howard	Reprint from the Journal of the Maine Water Utilities Association dated July 1950	Whitman & Howard, Inc. (see pages B-2 through B-7)
Application for Dam Registration	State of Maine Registration form dated March 1977	Maine Soil and Water Conservation Commission Department of Agriculture State of Maine State Office Building Augusta, Maine 04333 (see page B-8)

New Boulter Dam and Reservoir

By Paul F. Howard

Reprint from July 1950 Issue of the Journal of the Maine Water Utilities Association

Boulter Dam

By Paul F. Howard*

The Kittery Water District secures all but a small portion of its water supply from two reservoirs known as Folly Pond and Middle Pond which are located about seven miles northeast of Kittery Village. The upper reservoir, Folly Pond, has a capacity of about 250 million gallons and its spillway is 251 ft. above mean sea level. The water from this reservoir flows into Middle Pond which has a capacity of about 300 million gallons and its overflow is at elevation 228. A small portion of the water supply is secured from Cottle Spring in Elliot.

During August, 1949, due to the extended drought and heavy water consumption, the water level in the reservoirs was down so low that they contained only about a month's supply. On August 15, the emergency diesel engine driven pumping station, built during March, 1942 as a war time measure was put into operation and eighty-five million gallons were pumped from Chases Pond into Folly Pond up to November 23, 1949 when pumping ceased.

Folly and Middle ponds have a combined watershed including water surface of about one and one-third square miles. During the years 1945 to 1949 inclusive, the total precipitation for the five-year period, as measured at Durham, N.H., was 16.51 feet. This total depth of precipitation multiplied by the watershed area gives a total value of 4.591 billion gallons. During this same five-year period the Kittery Water District took from the reservoirs in this watershed 2,390,000,000 gallons, or about 52% of the total precipitation. These figures have been corrected for water taken from Chases Pond and for differences in quantity of water in storage January 1, 1945 and January 1, 1950. Thus it may be seen that the average daily yield of these reservoirs during this five-year period was 1,320,000 gallons per day which is equal to one million gallons per day per square mile.

The future water supply requirements of the Kittery Water District are very problematical due to the fact that it supplies the Portsmouth Navy Yard which is located in Kittery. The quantity of water used by the Navy Yard varies greatly from time to time as their activities and practices change.

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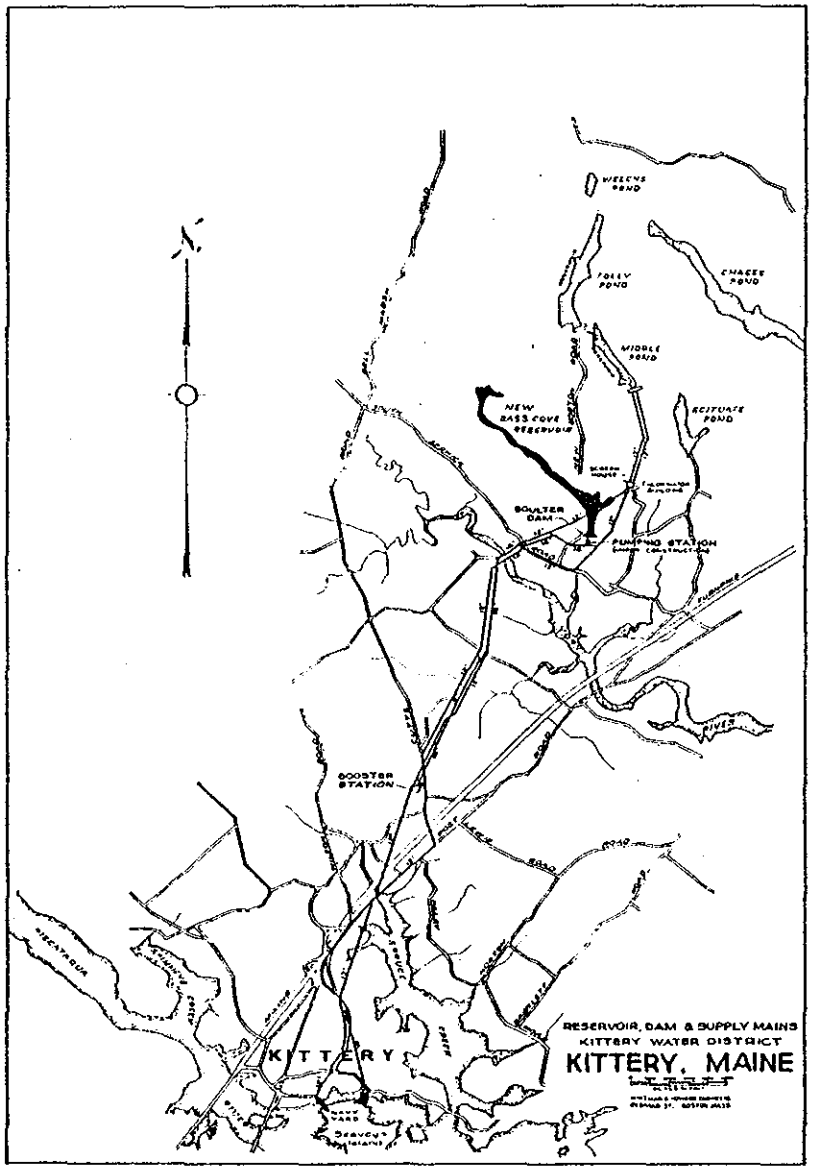
*Whitman & Howard, Engineers, Boston, Mass.



The average daily quantity of water supplied from the Folly Pond and Middle Pond Reservoirs and Chases Pond during the years 1945 to 1949, inclusive, were:

1945 — 1.80 million gallons per day
1946 — 1.72 million gallons per day
1947 — 1.24 million gallons per day
1948 — .98 million gallons per day
1949 — 1.31 million gallons per day

Based on studies made by ourselves and data furnished by the Navy we estimate that in 1970 the average daily water consumption may be about 3.2 million gallons per day and the maximum about 5 million gallons per day.

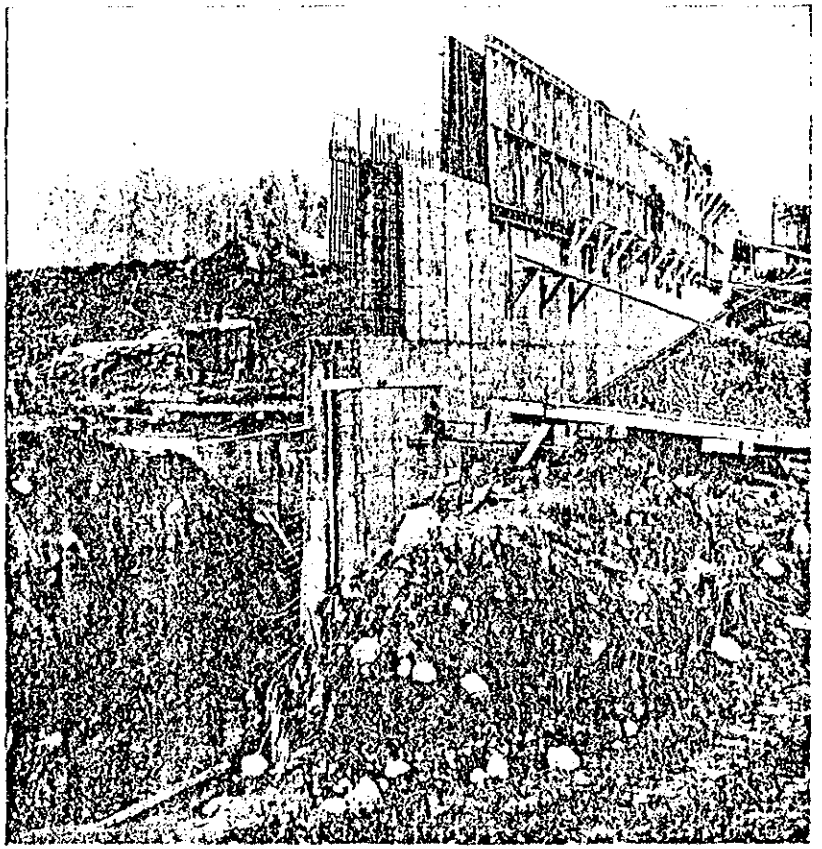
The present water supply works, including Cottle Spring, are believed to be capable of yielding continuously an average daily supply of 1.4 million gallons. Thus it may be seen that another supply that would yield about 1.8 million gallons per day would be necessary to meet the estimated 1970 requirements.

After considerable investigation, a site was selected on Bass Cove Creek and a dam built with spillway 75-feet above mean sea level which will impound 500 million gallons with a water surface area of about 105 acres and a watershed of about 2.3 square miles.

The dam is of earth fill construction with concrete core wall, and has a spillway at one end cut through rock. The dam is about 930 ft. in length and has a maximum height above the original earth surface of 41 ft. The concrete core wall is 2 feet wide at the top and has a batter of 1 foot in fifty on both sides. The core wall sets on ledge for its entire length and has a maximum height of 70 feet.

The ledge below the core wall was grouted to prevent or minimize leakage through seams in the ledge rock under the dam. The grout holes were drilled 12-inches on centers to a depth of 12 feet, and filled with grout under pressure consisting of 1 part Portland cement and 1 part sand. An average of ¾ cu. ft. of grout was pumped into each hole. At times the grout came out through holes drilled in the ledge 4 or 5 feet away. The pipes from the grout holes were extended up through the core wall forms and through the side of the forms at a height of about 4 feet above the ledge. Grout was not placed until at least one 10-foot lift of the core wall had been poured.

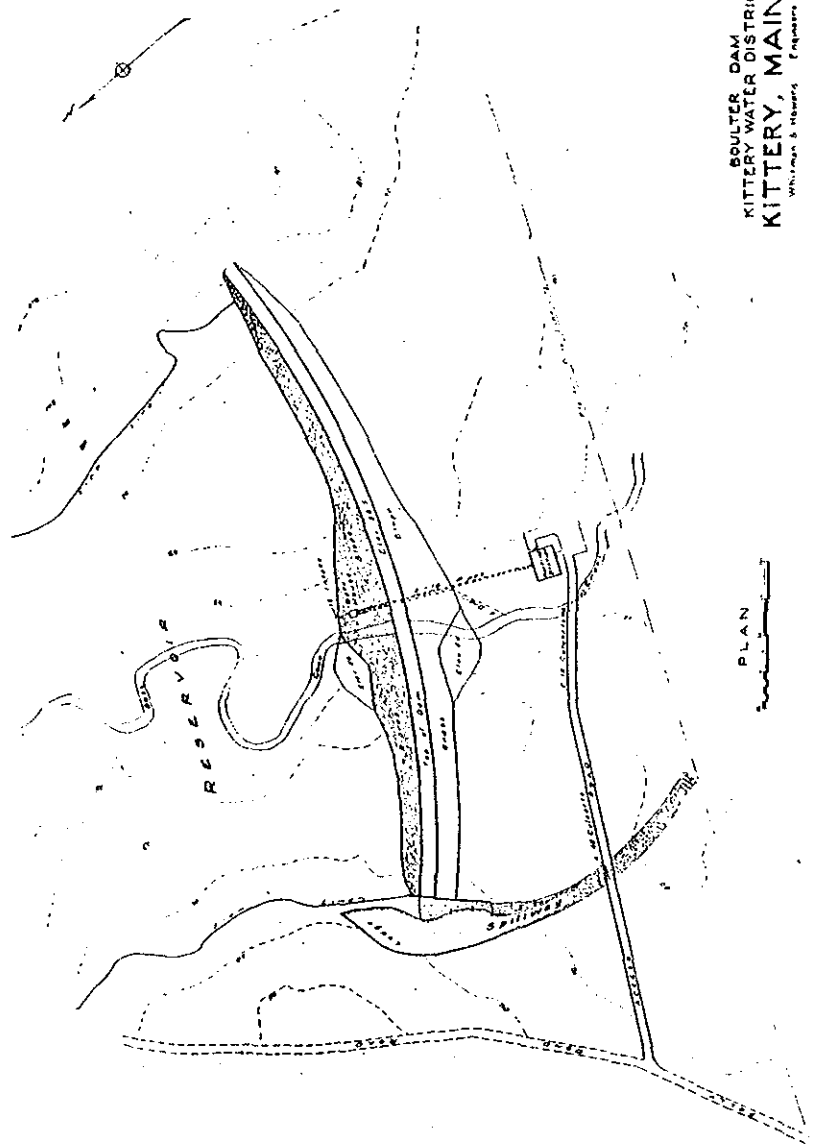
The concrete core wall was placed in 10 foot lifts. The forms were continuous with bulkheads located as required by a day's pour depending on the weather, temperature, etc.

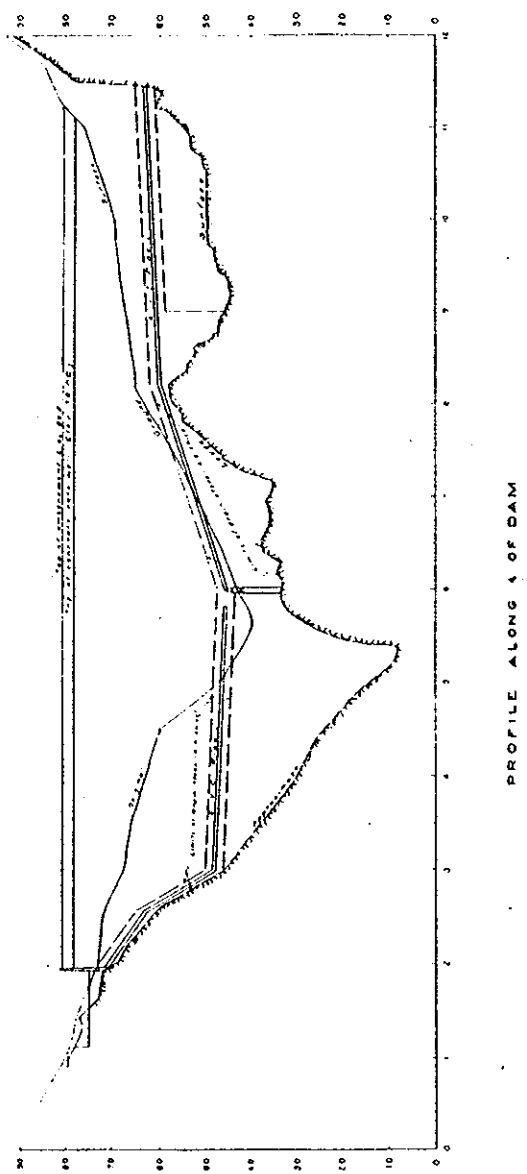


COREWALL CONSTRUCTION

The concrete was designed to have a minimum compressive strength of 2500 pounds per square inch. An air entraining agent was used in the concrete which, together with mechanical vibrators, gave a dense uniform concrete mass without voids in the concrete, and which prevented the water from raising to the surface and the formation of a laitance at the top surface of each pour.

The matter of construction and expansion joints was given serious consideration and it was concluded to build the dam without expansion joints. Five-eighths inch steel reinforcing bars were placed in two directions close to the surface of each side of the core wall in order to prevent the formation of large expansion and shrinkage cracks due to





changes in temperature, etc. This seems to have been successful as only minute hair line cracks were observed previous to filling about the core wall. The construction joints, both in horizontal and vertical directions, were built with 4-inch by 6-inch concrete key ways. Steel water stops were installed at each construction joint of ¼-inch by 12-inch steel plates which were arc welded at all joints.

A drainage system was constructed along the down stream face of the core wall. This consisted of a 6-inch concrete pipe with 3-inch to 6-inch stone to a thickness of 4 feet placed around the pipe. The drains discharge into the old creek joint below the tow of the dam.

The spillway has a capacity of 2,500 cu. ft. per second. This will take care of the maximum one hour rain fall along the New England coast plus melting snow. The extra storage above the spillway will take care of a storm of twice the record one hour storm, thus giving a quite large factor of safety.

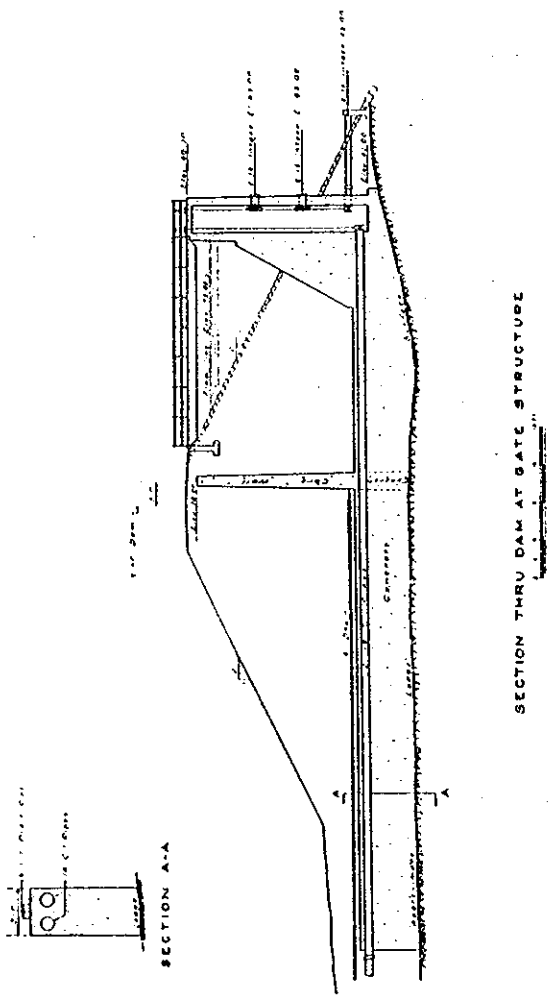
The intake tower is so arranged that water can be drawn into the intake tower through 16-inch diameter intakes at three elevations. Sluice gates are to be placed on the two upper intakes and an ordinary gate valve on the lower intake. The sluice gates are used at the higher levels rather than gate valves due to the danger of ice formation breaking the bonnets of gate valves.

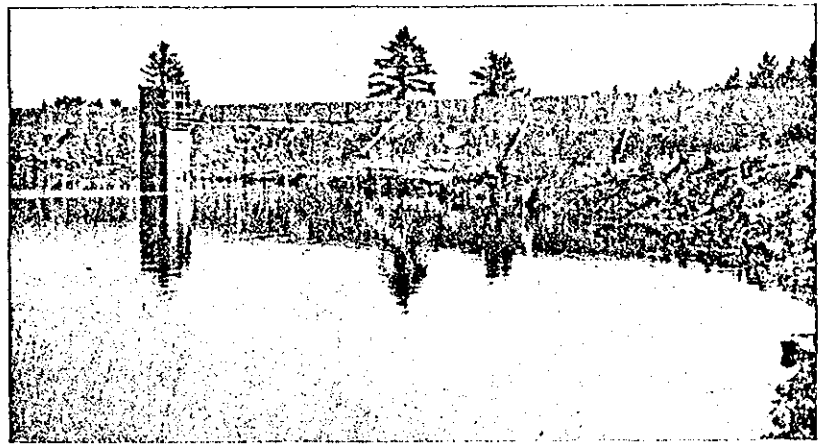
Water will flow from the reservoir to the pumping station yet to be built, through either or both of the 16-inch pipe lines which extend through the dam encased in a reinforced concrete supporting structure. A blow-off is to be provided to discharge into the old stream bed below the dam in order to flush out any accumulations that there may be in the vicinity of the intake.

The upper face of the earth fill of the dam is paved with stone rip rap. The lower face is to be grassed.

The trees, brush, etc. have been cleared from the reservoir area. The surface was not raked to remove the leaves, twigs, etc. due to the great expense involved, although it would have been very desirable.

The cost of constructing the dam and reservoir, including payments for land, will be about $436,000. There remains to be constructed the first section of the proposed pumping station with one electric motor driven pump and some piping connections which will bring the total cost of this undertaking to a little less than the original estimated cost of $500,000.





INTAKE WORKS AND UPSTREAM FACE OF DAM

The construction work was performed under a negotiated contract by Landers and Griffin, Inc., of Portsmouth, New Hampshire. Due to the acuteness of the situation, actual construction was started within one week of the time that Whitman & Howard, Engineers, were instructed to undertake the work. Only preliminary plans had been developed when the construction work started. The plans were developed as the work continued, which required close co-operation between the engineers and contractors, and the excellent co-operation and workmanship of the contractors is appreciated by the engineers and trustees.

We wish to express our appreciation of the co-operation shown us by the trustees of the Kittery Water District; Messrs. George D. Boulter, Elmer J. Burnham, and Burnell E. Frisbee, and the superintendent, Francis T. Hatch. The work in the field was ably executed under the direction of Leslie Thurlow, resident engineer, and Nate T. Morse, engineer in charge of concrete.

APPLICATION FOR DAM REGISTRATION

Dam Registration Number 312 7
Date Received MAR - 1977
Fee Enclosed 9/10 00
Quad Sheet Name York
Quad Sheet Number B-3

ion:

y: York

ipality: Kittery Water District

of Dam: Boulter

of Impoundment: Boulter Pond

'ship:

of Owner: Kittery Water District

Name of Agent: (if different from Owner)

ss of Owner: 17 State Rd.

Address:

tery, Maine 03904

phone Number: 439-1128

Telephone Number:

ription of Dam

: Concrete Core Wall

truction Material: Concrete and Earth
(Concrete, wood, earth)

Originally built: 1951

Year last major repair: No repairs

ht: 36'

Width: Top 22' Bottom 120'

lway type: Concrete & Ledge

Spillway Width: 70'

unding Capacity: 120 Acres 650 MG
(Acre-feet)

Drawdown available: 30'
(feet)

Passage available?: At run off

Installed Electrical Generating Cap:

oses for which stored water is used: Public water supply for the towns of, Kittery
t of York, Eliot and Navy Yard

recent inspection by Qualified Engineer (Date):

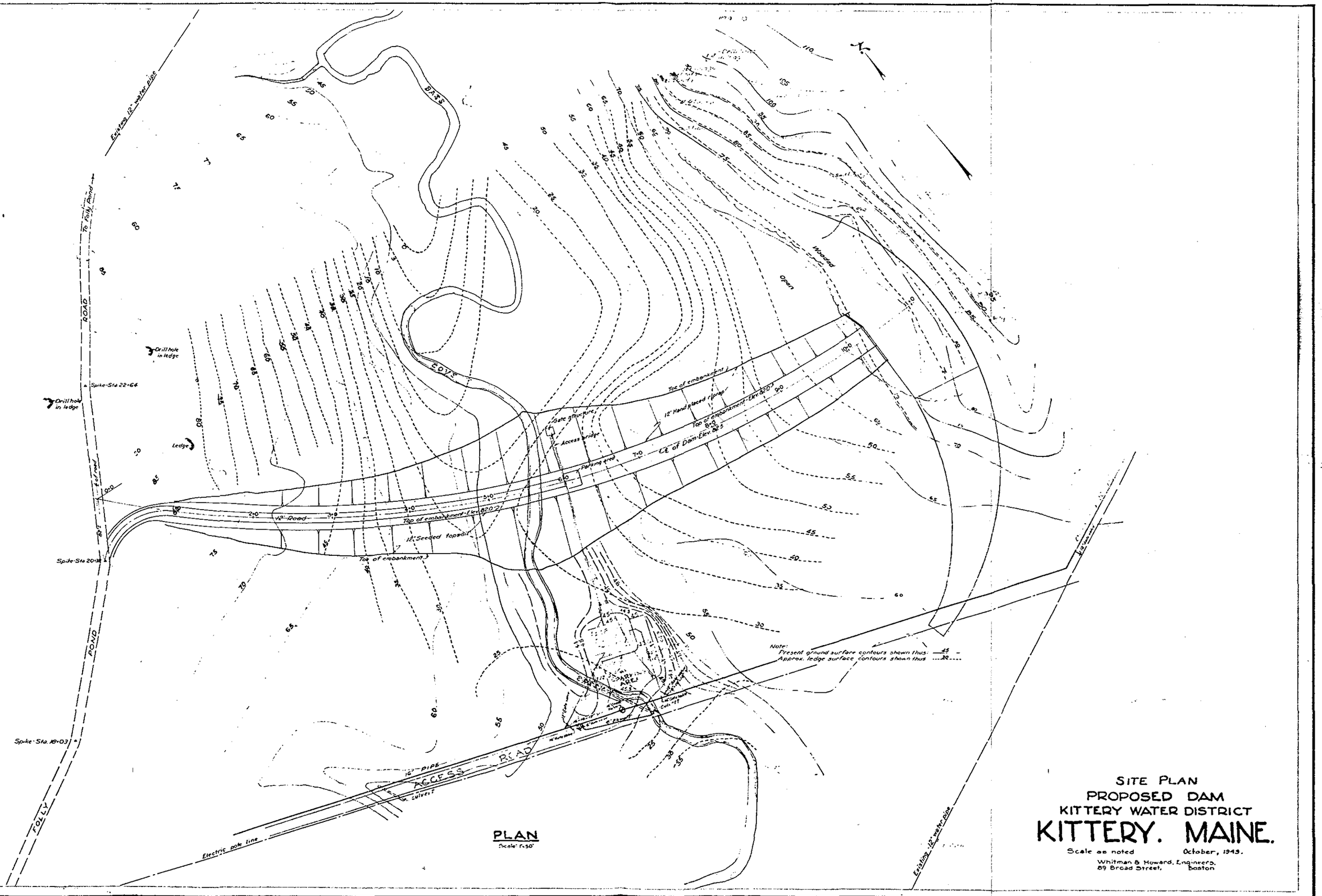
and Address of Engineer:

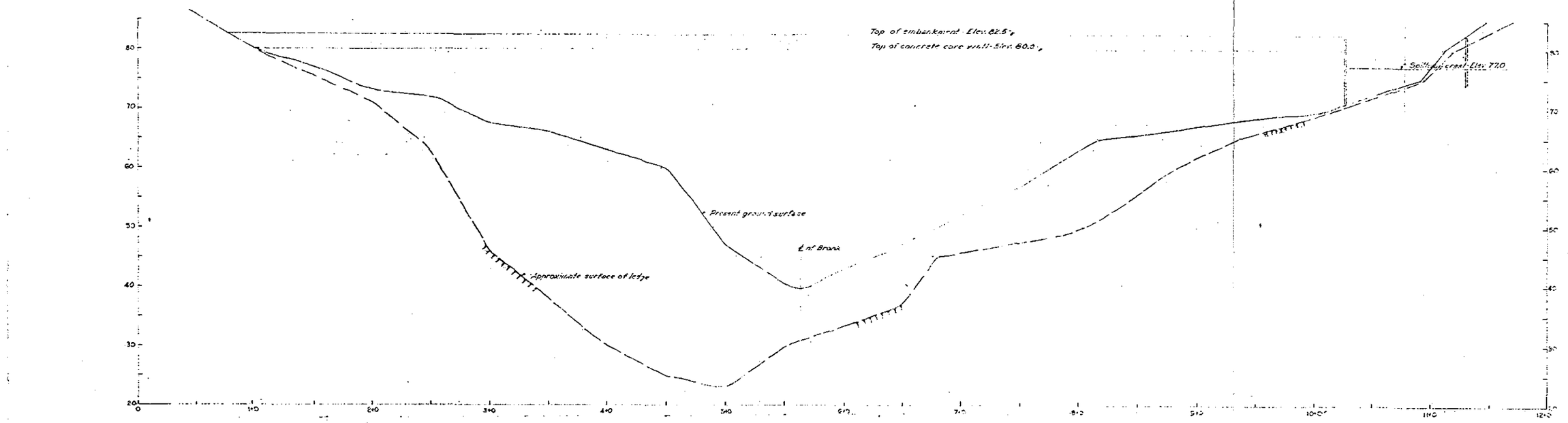
er Permits applicable:

C #14

Map in File 5123

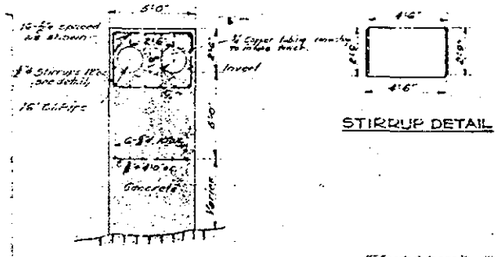
B-8


Existing 12" water pipe
To Folly Pond
ROAD
BASS
COVE
Drill hole in ledge
Spike-Sta 22+64
Drill hole in ledge
Ledge
Spike-Sta 20+38
Spike-Sta 18+03
FOLLY POND
Wooded
Open
Top of embankment Elev 820.0
12" Hand placed riprap
Gate Structure
Access bridge
Parking area
℄ of Dam-Elev 825
12" Road
Top of embankment-Elev 820.2
12" Seeded topsoil
Top of embankment
16" PIPE
ACCESS ROAD
Culvert
Electric pole line
Existing 12" water pipe
Note:
Present ground surface contours shown thus: 45
Approx. ledge surface contours shown thus: 40
PLAN
Scale: 1"=50'
SITE PLAN
PROPOSED DAM
KITTERY WATER DISTRICT
KITTERY. MAINE.
Scale as noted
October, 1943.
Whitman & Howard, Engineers,
89 Broad Street, Boston



PROFILE ALONG ℄ OF DAM

Scale: Horiz. 1"=40'
Vert. 1"=8'



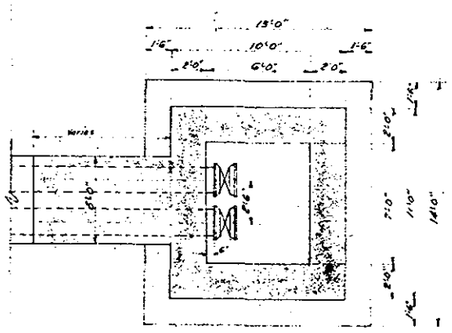
TYPICAL SECTION
THRU DISCHARGE PIPES

Scale ½"=1'-0"

STIRRUP DETAIL

SECTION THRU DAM AT GATE STRUCTURE

Scale ½"=1'-0"



PLAN OF GATE STRUCTURE

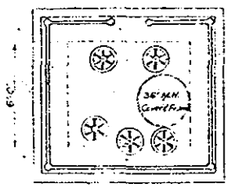
Scale ½"=1'-0"

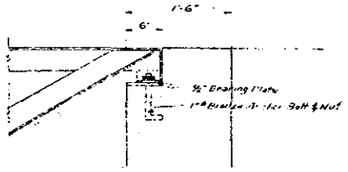
PROPOSED DAM
PROFILE & SECTION
KITTERY WATER DISTRICT

KITTERY, MAINE

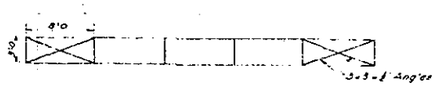
Scale as noted October, 1949

Wildman & Howard, Engineers
89 Broad Street Boston

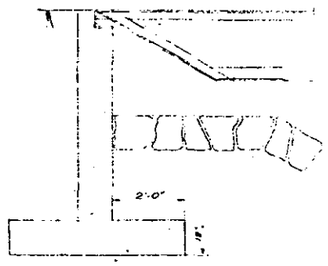




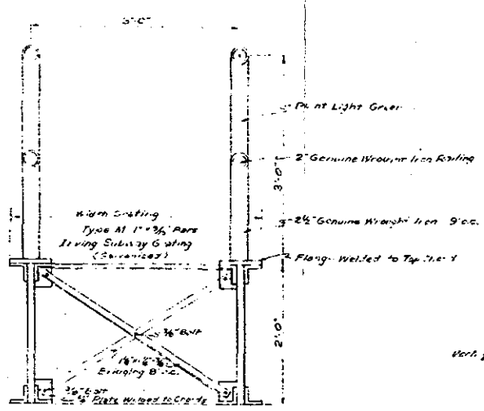
DETAIL OF TRUSS ANCHORS AT GATE STRUCTURE
Scale: 1"=1'-0"



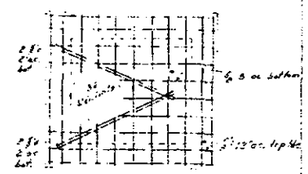
X-BRACING
Size 3/16"



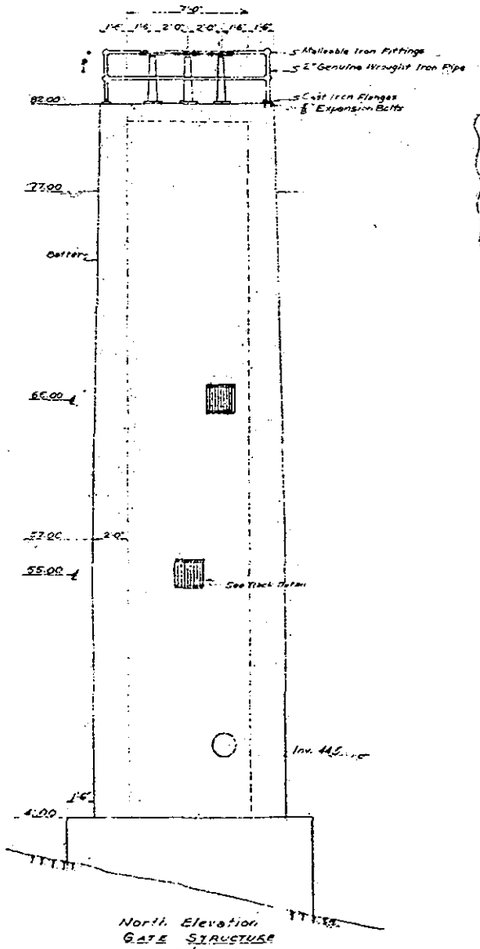
GATE STRUCTURE ABUTMENT DETAIL
Scale: ½"=1'-0"



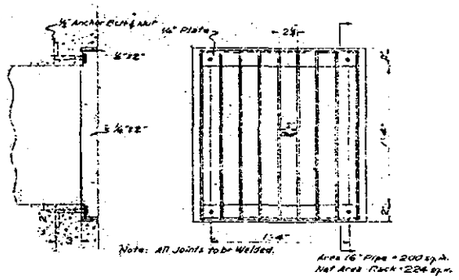
RAILING TO GATE STRUCTURE DETAIL
Scale: 1"=1'-0"



PLAN SHOWING TOP REINFORCING



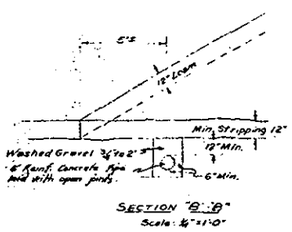
North Elevation
GATE STRUCTURE
Scale ¼"=1'-0"



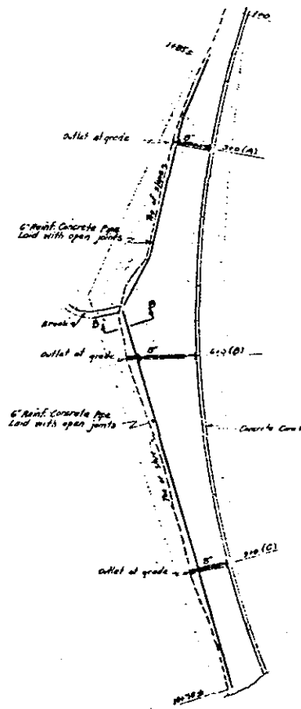
Note: All Joints to be Welded.

Area 16" Pipe = 200 sq. in.
Net Area Rock = 224 sq. in.

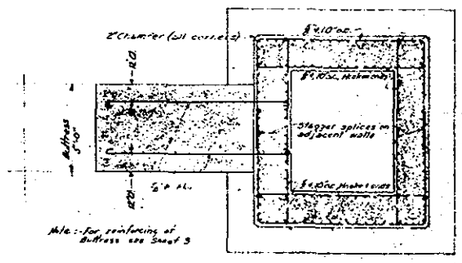
RACK DETAIL
Scale: 1½"=1'-0"



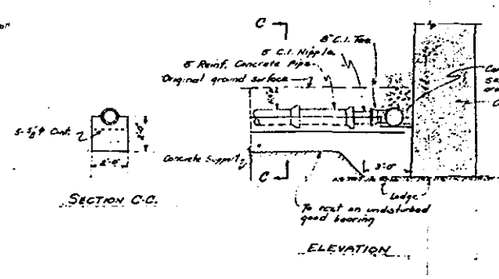
SECTION "B"-"B"
Scale: ½"=1'-0"



PLAN OF UNDERDRAINS
Scale: 1" = 100 ft.

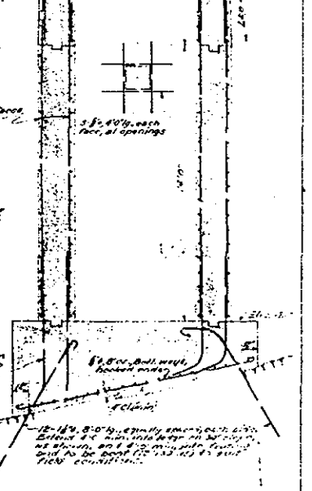


PLAN SHOWING ARRANGEMENT OF HORIZONTAL STEEL
Scale 1"=1'-0"



SECTION C-C.

DETAIL OF DRAINS AT A, B & C
Scale: ½"=1'-0"



SECTION
Scale ¼"=1'-0"

PROPOSED DAM
INTAKE TOWER, DRAINS ETC.
KITTERY WATER DISTRICT

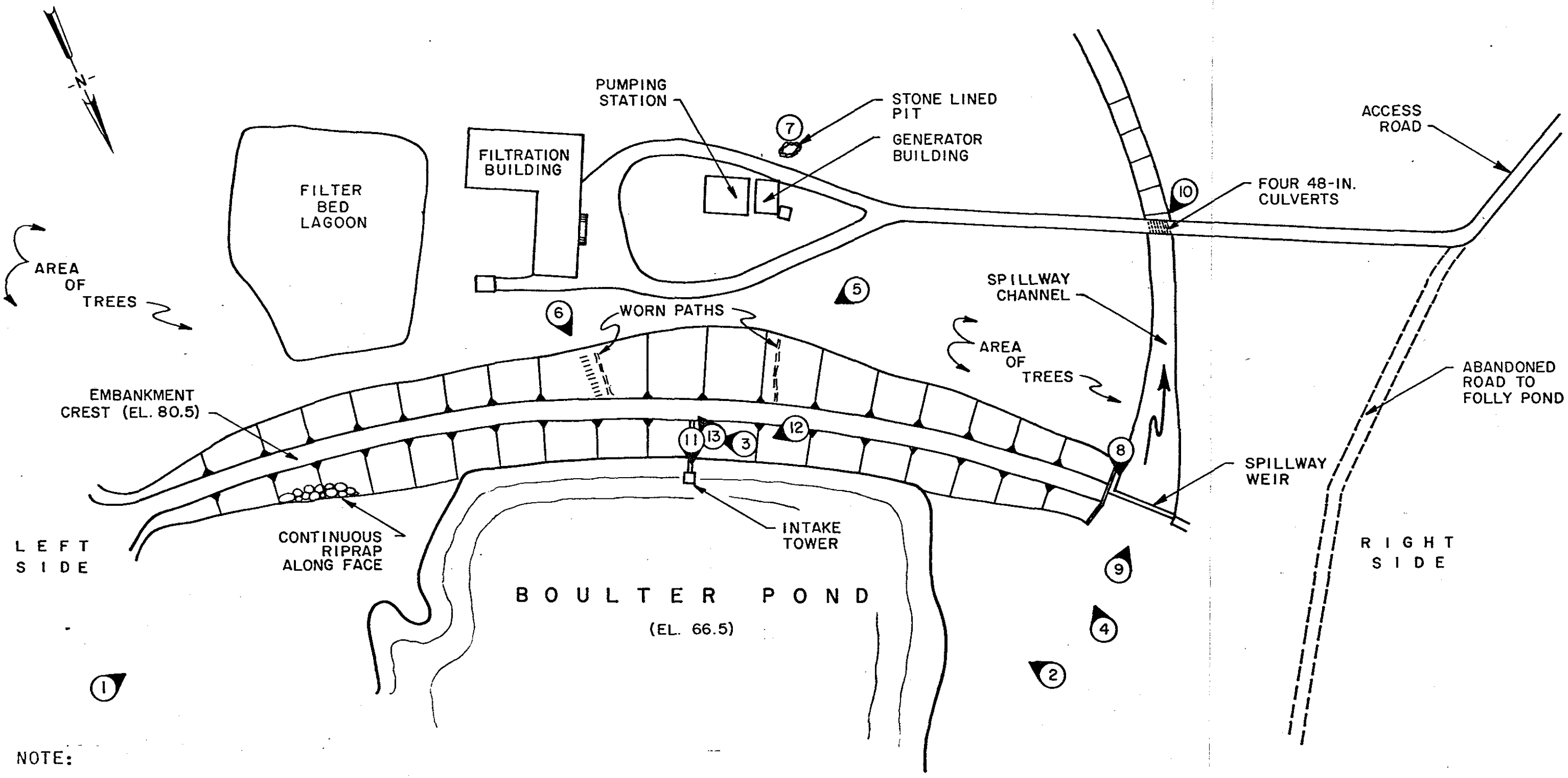
KITTERY, MAINE

Scale as noted October, 1940

Whitman & Howard, Engineers
89 Broad Street Boston.

APPENDIX C - PHOTOGRAPHS

				Page
LOCATION PLAN				
Site Plan Sketch				C-1
PHOTOGRAPHS				
No.	Title	Roll	Frame	Page
1.	Overview of Boulter Dam showing upstream side from left abutment	11	12	vi
2.	Overview of Boulter Dam showing upstream side from right abutment	B7	26A&27A	C-2
3.	View of riprap near service bridge	11	10	C-3
4.	Right end of earth embankment, upstream	11	8A	C-3
5.	Downstream slope of embankment near center of dam	11	14	C-4
6.	Stone steps on downstream slope	11	16	C-4
7.	Stone lined drainage pit downstream of dam	11	23	C-5
8.	Flashboards, training wall and spillway weir with spalling concrete	B7	29A	C-5
9.	Spillway approach looking downstream	B7	24A&25A	C-6
10.	Conduits under access roadway, downstream	11	6	C-7
11.	Intake tower manual gate operators	11	17	C-7
12.	Intake tower and steel service bridge	B7	32A	C-8
13.	Service bridge abutment	11	20	C-8



NOTE:

PLAN DEVELOPED FROM "SITE PLAN, PROPOSED DAM, KITTERY WATER DISTRICT, KITTERY, MAINE" BY WHITMAN & HOWARD, ENGINEERS, DATED OCTOBER, 1949 (SEE PAGE B-9) AND FIELD OBSERVATIONS MADE ON 2 NOVEMBER 1980.

LEGEND:

(2) PHOTO NUMBER AND DIRECTION OF VIEW

Boulter Dam
York, ME

SITE PLAN SKETCH

Approx. Scale: 1" = 100' February 1980

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

2. Overview of Boulter Dam showing upstream side from right abutment

3. View of riprap near service bridge

4. Right end of earth embankment, upstream

5. Downstream slope of embankment near center of dam

6. Stone steps on downstream slope

7. Stone lined drainage pit downstream of dam

8. Flashboards, training wall and spillway weir with spalling concrete

9. Spillway approach looking downstream

10. Conduits under access roadway, downstream

11. Intake tower manual gate operators

12. Intake tower and steel service bridge

13. Service bridge abutment

APPENDIX D - HYDRAULIC AND HYDROLOGIC COMPUTATIONS

MAPS	Page
Drainage Area Map	D-1
Dam Failure Impact Area Map	D-2

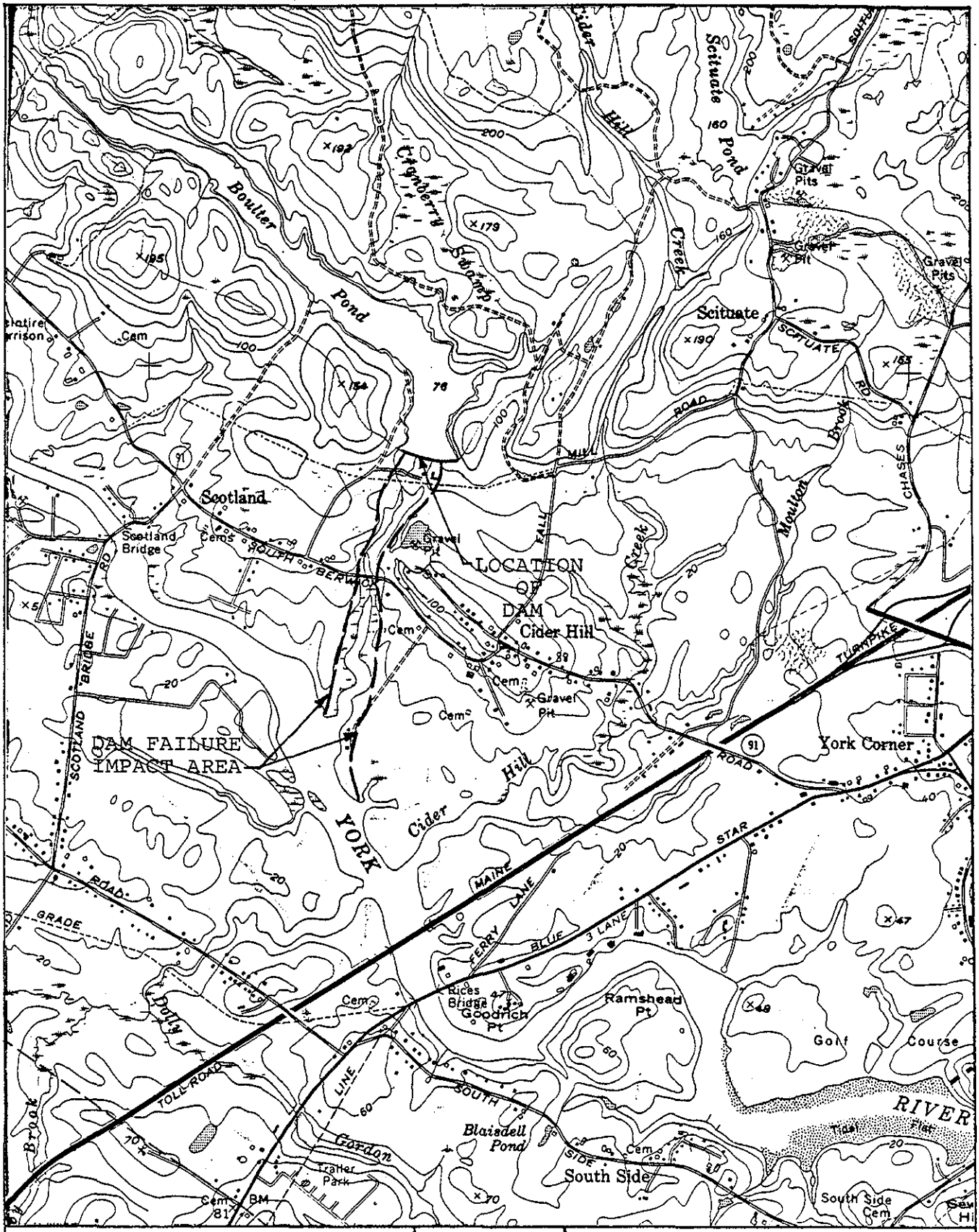
COMPUTATIONS

Elevations, Surface Areas, Storage Capacitites, Size Classification and Hazard Classification	D-3
Test Flood Determination, Stage-Discharge Relationships and Surcharge-Storage Routing	D-4
Stage-Discharge and Storage-Elevation Curves	D-5
Tailwater Analysis	D-7
Outlet Works	D-8
Dam Failure Analysis	D-9

BOULTER DAM
ME 00194

DRAINAGE AREA
MAP

APPROX. SCALE: 1" = 2000'



BOULTER DAM
ME 00194

DAM FAILURE
IMPACT AREA MAP

APPROX. SCALE: 1" = 2000'

ELEVATIONS

Top of Dam Elev. 80.5
Spillway Crest Elev. 75.0
Toe of Dam Elev. 39.5
Inv. of Outlet Works:
3 - 16"ϕ Intakes at ℄ Elev. 45.0, 55.0, & 65.0
2 - 16"ϕ outlets at Inv. Elev. 41.5
Length of Dam: 930 ft. (not incl. spillway)
Length of Dam at mid-height: 330 ft. (scaled from constr. drawg)

SURFACE AREAS

* Drainage Area = 2.3 sq. mi.

* W.S. area at spillway crest: Elev. 75.0 = 105 ac.; Elev. 77.0 = 120 ac.
W.S. area at contour 80.0 = 134 acres
W.S. area at top of dam (Elev. 80.5) = 137 acres by extrapolation

STORAGE CAPACITIES

* Spillway crest: Elev. 75.0 = 500 MG = 1,535 ac.-ft.; Elev. 77.0 = 650 MG = 1,995 ac-ft.
Elev. 80.0 = 1,995 + (120+134)/2 × 3 = 2,376 ac-ft.
Top of Dam (Elev. 80.5) = 2,376 + (134+137)/2 × 0.5 = 2,444 ac-ft.

*: from July 1950 issue of the Journal of the Maine Water Utilities Association by Paul F. Howard, Design Engr. and 1977 Registration Info. by owner

SIZE CLASSIFICATION

Height = 80.5 - 39.5 = 41 ft.

Storage at Top of Dam = 2,444 acre-ft.

∴ Size is INTERMEDIATE based on both the height and storage capacity

HAZARD CLASSIFICATION

Based on the dam failure analysis, pages 7 & 8, a failure would result in the potential loss of a few lives.

∴ Hazard Classification is SIGNIFICANT

TEST FLOOD DETERMINATION

For an Intermediate size and Significant hazard, COE Guidelines give 1/2 PMF to PMF range, adopt 1/2 PMF for Test Flood.

The water shed consists of undeveloped, rolling terrain. Use 2100 CSM for PMF inflow for 2.3 sq. mi. D.A.

∴ Test Flood Inflow = 2.3 sq. mi. x 2100 cfs/sq. mi. x 1/2

= 2,400 cfs

STAGE - DISCHARGE RELATIONSHIPS

Spillway Length = 70.0 ft.

W/o Flashboards: Crest Elev. 75.0; assume "C" = 2.8 for all depths to account for tailwater

W/ Flashboards: Crest Elev. 77.0
"C" value varies from 3.3 to 4.0

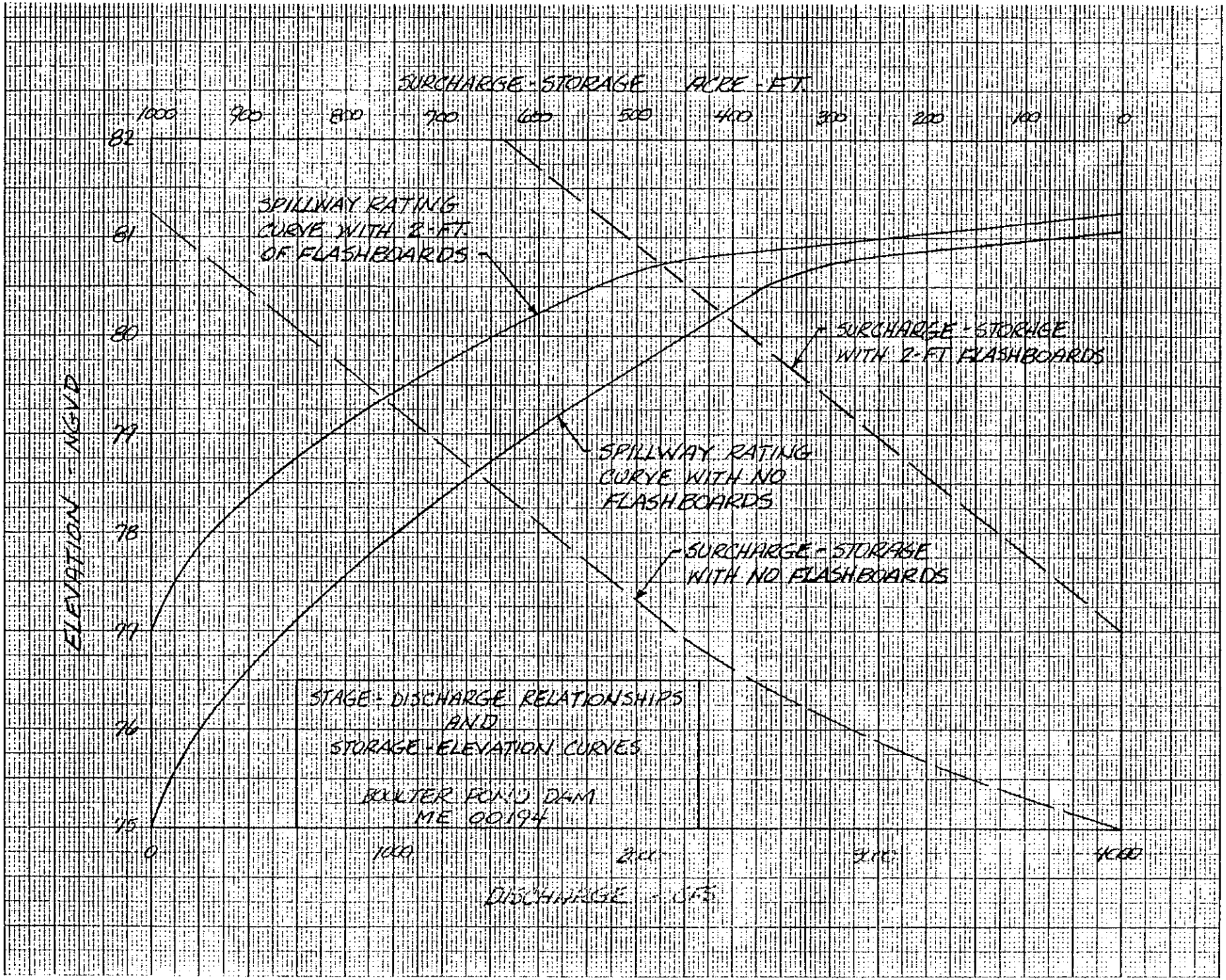
W.S. ELEV.	W/o FLASHBOARDS		W/ FLASHBOARDS		SURCHARGE - STORAGE	
	"C"	Q (cfs)	"C"	Q (cfs)	W/o Flash	W/ Flash.
75.0	2.8	0	-	-	0	-
76.0	2.8	200	-	-	275	-
77.0	2.8	550	3.3	0	460	0
78.0	2.8	1,020	3.5	250	585	125
79.0	2.8	1,570	3.7	730	715	255
80.0	2.8	2,190	3.9	1,420	841	381
80.5	2.8	2,530	4.0	1,830	909	449
81.0	2.8	3,740	4.0	3,090	970	510

SURCHARGE - STORAGE ROUTING

A. W/o Flashboards

Test Flood Inflow = 2,400 cfs = Q_{P_1}
Surcharge Height to pass Q_{P_1} = Elev. 80.3

$$STOR_1 = \frac{880 \text{ ac-ft} \times 12"/\text{ft}}{2.3 \text{ mi}^2 \times 640 \text{ ac./mi}^2} = 7.174"$$


SURCHARGE - STORAGE ACRE - FT.
1000
900
800
700
600
500
400
300
200
100
0
82
81
80
79
78
77
76
75
ELEVATION - NGVD
SPILLWAY RATING CURVE WITH 2-FT. OF FLASHBOARDS
SURCHARGE - STORAGE WITH 2-FT. FLASHBOARDS
SPILLWAY RATING CURVE WITH NO FLASHBOARDS
SURCHARGE - STORAGE WITH NO FLASHBOARDS
STAGE - DISCHARGE RELATIONSHIPS AND STORAGE - ELEVATION CURVES
KALTER FOR U DAM
ME 00194
0
1000
2000
3000
4000
DISCHARGE - CFS

Page 3

$$Q_{P2} = Q_{P1}\left(1 - \frac{STOR}{9.5''}\right)$$

$= 2400\,(1 - 7.174/9.5) = 590$ cfs

Surcharge Height to pass Q_{P2} = 77.1

$$STOR_2 = \frac{472 \text{ ac-ft} \times 12''/\text{ft.}}{2.3 \text{ mi}^2 \times 640 \text{ ac./mi}^2} = 3.848''$$

$STOR_{A_1} = (3.848 + 7.174)/2 = 5.511''$

$Q_{P3} = 2400\,(1 - 5.511/9.5) = 1{,}010$ cfs

Surcharge Height to pass Q_{P3} = 78.0

$$STOR_3 = \frac{585 \text{ ac-ft} \times 12''/\text{ft.}}{2.3 \text{ mi}^2 \times 640 \text{ ac./mi}^2} = 4.769''$$

$STOR_{A_2} = (5.511 + 4.769)/2 = 5.14''$

$Q_{P4} = 2400\,(1 - 5.14/9.5) = 1{,}100$ cfs

TEST FLOOD INFLOW = 2400 cfs
ROUTED TEST FLOOD OUTFLOW = 1,100 cfs
TEST FLOOD ELEVATION = 78.2

B. WITH 2-FT. FLASHBOARDS

Test Flood Inflow = 2400 cfs = Q_{P1}
Surcharge Height to pass Q_{P1} = Elev. 80.85

$$STOR_1 = \frac{490 \text{ ac-ft} \times 12''/\text{ft.}}{2.3 \text{ mi}^2 \times 640 \text{ ac./mi}^2} = 4.0''$$

$Q_{P2} = 2400\,(1 - 4.0/9.5) = 1390$ cfs

Surcharge Height to pass Q_{P2} = 80.0

$$STOR_2 = \frac{381 \text{ ac-ft.} \times 12''/\text{ft.}}{2.3 \text{ mi}^2 \times 640 \text{ ac./mi}^2} = 3.11''$$

$STOR_{A_1} = (3.11 + 4.0)/2 = 3.555''$

$Q_{P3} = 2400\,(1 - 3.555/9.5) = 1{,}500$ cfs

Surcharge Height to pass Q_{P3} = 80.1

$$STOR_3 = \frac{395 \text{ ac-ft} \times 12"/\text{ft.}}{2.3 \text{ mi}^2 \times 640 \text{ ac./mi}^2} = 3.22"$$

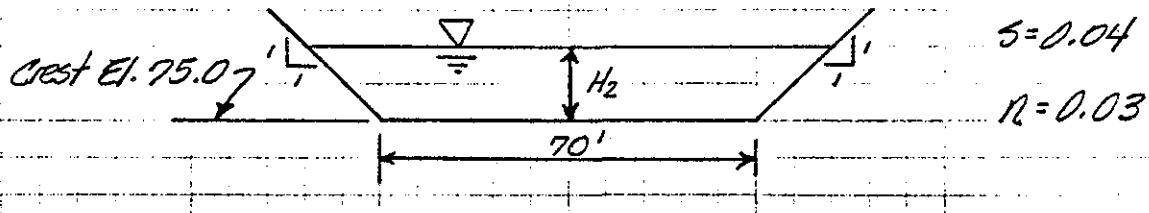
$$STOR_{A_2} = (3.555 + 3.22)/2 = 3.388"$$

$$Q_{P4} = 2400\,(1 - 3.388/9.5) = 1,540 \text{ cfs}$$

TEST FLOOD INFLOW = 2,400 cfs
ROUTED TEST FLOOD OUTFLOW = 1,540 cfs
TEST FLOOD ELEVATION = 80.15

TAILWATER ANALYSIS

Spillway discharge control channel is:



$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2} = \frac{1.49}{0.03} A R^{2/3} (0.04)^{1/2}$$

$$\therefore Q = 9.933\, A R^{2/3}$$

If $H_2 = 2.0'$, $Q = 9.933\,(144)\left(\frac{144}{70+5.7}\right)^{2/3} = 2196$ cfs

If $H_2 = 2.5'$, $Q = 9.933\,(181)\left(\frac{181}{70+7}\right)^{2/3} = 3178$ cfs

$$Q_s = Q_f \left[1 - \left(\frac{H_2}{H_1}\right)^{1.5}\right]^{0.385}$$

where Q_s = submerged spillway discharge
Q_f = free spillway discharge
H_2 = d/s channel water depth
H_1 = head over weir

A. WITHOUT FLASHBOARDS

If free discharge were to occur (ie: no tailwater submergence of conc. weir) then "C" = 3.2. For full head ($H_1 = 5.5'$) and free discharge,

$$Q_f = 3.2 \times 70 \times (5.5)^{1.5} = 2{,}890 \text{ cfs}$$

at $Q_f = 2{,}890$ cfs, $H_2 = 2.0 + \left(\frac{2890-2196}{3178-2196}\right) \times 0.5 = 2.35$

then $Q_s = 2890\left[1-\left(\frac{2.35}{5.5}\right)^{1.5}\right]^{0.385} = 2890 \times (0.882) = 2{,}550$ cfs

Set $Q_f = Q_s$ and find "C" value:

$Q_f = CLH^{3/2}$; $C = Q_f / LH^{3/2}$

$= 2550 / 70 (5.5)^{3/2}$

$= 2.82$, say 2.8

B. WITH 2 FT. FLASHBOARDS

At full head ($H_1 = 3.5'$), $Q_f = 4.0 \times 70 (3.5)^{1.5} = 1830$ cfs

$H_2 < 2.0'$ or $<$ El. 77.0 ∴ no submergence

TEST FLOOD TAILWATER ELEV.

Without flash boards $Q = 1{,}100$ cfs, Elev. 76.2

With flashboards $Q = 1540$ cfs, Elev. 76.6

OUTLET WORKS

One 16"ϕ CI pipe from Control Tower to Bass Cove Creek. Inv. at Control Tower = El. 41.5, assume inlet control. Discharge capacity with pond at normal pool (elev. 77.0)

$Q = CA\sqrt{2gh} = 0.65 \times 1.4 \times \left[2 \times 32.2 \times (77-41.5)\right]^{1/2} = 43.5$ cfs, say 40 cfs

DAM FAILURE ANALYSIS

Spillway discharge prior to failure w/reservoir water surface at top of dam (H = 5.5 ft.)

$$Q_s = 2.8 \times 70 \times (5.5)^{3/2} \simeq 2{,}530 \text{ cfs}$$

Max. height of dam is 41 ft., Length of dam at mid-height is ~330 ft.

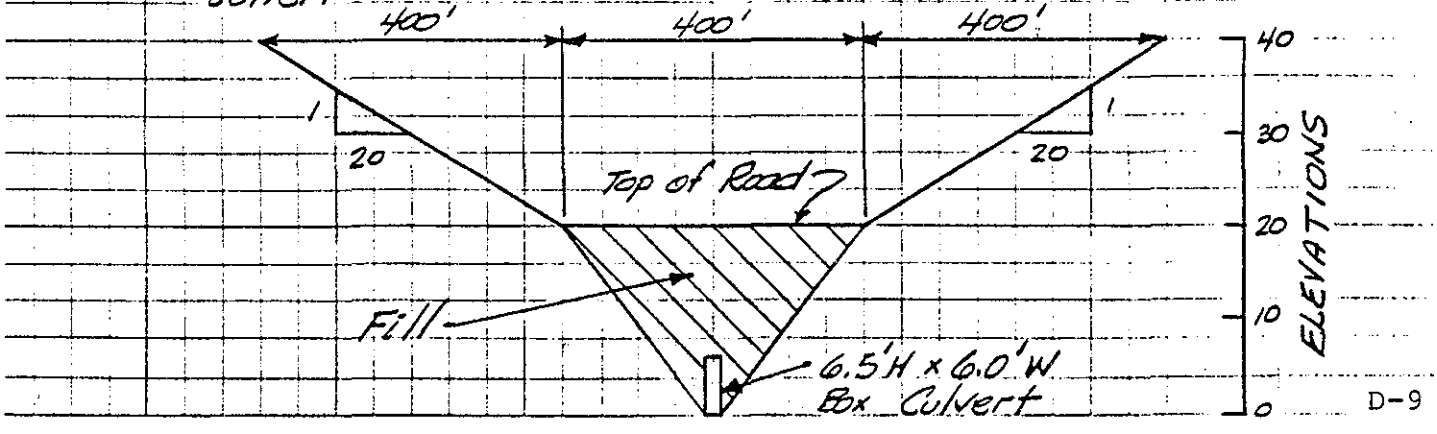
$$Q_f = 8/27\,(32.2)^{1/2}(0.4 \times 330)(41)^{3/2} = 58{,}260 \text{ cfs}$$

Combined outflow at assumed failure:

$$Q_{P_1} = 58{,}260 + 2{,}530 \simeq 60{,}800 \text{ cfs}$$

Discharges from Boulter Pond Dam are conveyed approximately 2,400 ft. by an unnamed brook to the tidal portion of the York River approx. 1 mile upstream of the Maine Turnpike. The brook crosses South Berwick Road (Route 91) approx. 2,100 ft. d/s of the dam. There are no dwellings located along the brook which might be affected by a dam failure. However, two dwellings are located on the left bank of the York River near the confluence of the Boulter Pond brook which would be affect by a dam failure flow in the magnitude of 61,000 cfs. Furthermore, the pumping station and treatment plant which are located at the toe of the dam and are generally manned, would be destroyed by a dam failure.

Determine amount of overtopping of the Rte. 91 culvert:



Culvert Flow $(Q_c) = CA\sqrt{2gH} = 0.75 \times 39 (64.4H)^{1/2} = 29.25 (64.4H)^{1/2}$

Flow over roadway $(Q_R) = CLH^{3/2} = 2.8 \times L (H)^{1.5}$

W.S. ELEV.	Q_c (cfs)	Q_R (cfs)	Q_T (cfs)
20	960	—	960
22	1,020	3,390	4,410
24	1,070	10,230	11,300
26	1,120	19,950	21,070
28	1,170	32,510	33,680
30	1,210	47,940	49,150
32	1,260	66,310	67,570

by interpolation, at $Q_{P_1} = 60,800$ cfs, W.S. Elev. at Route 91 would be approx. elev. 31.3 or 11+ ft. over top of road.

Although the magnitude of a dam failure wave (61,000 cfs) would be great, the probable economic damages are relatively low and the potential loss of life only a few.

Therefore Hazard Classification is SIGNIFICANT

APPENDIX E - INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

[1]

PART I – INVENTORY OF DAMS IN THE UNITED STATES

(PURSUANT TO PUBLIC LAW 92–367)

See reverse side for instructions.

STATE	IDENTITY NUMBER
ME	00194

IDENTIFICATION

[2] DIVISION	[3] STATE	[4] COUNTY	[5] CONGR DIST	[6] STATE	[7] COUNTY	[8] CONGR DIST	[9] NAME	[10] LATITUDE (North) ° ′	[11] LONGITUDE (West) ° ′	[12] REPORT DATE DAY	MO	YR
NE	DME	031	01				BØULTER DAM	4309.8	07041.6	30	JAN	80

IDENTIFICATION (Continued)

[13] POPULAR NAME	[14] NAME OF IMPOUNDMENT
	BØULTER PØND

LOCATION

[15] REGION	[16] BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY – TOWN – VILLAGE	[17]	[18]	[19] DIST. FROM DAM (mi)	[20] POPULATION
01	04	BASS COVE CREEK	YORK			4	7110

STATISTICS

[21] TYPE OF DAM	[22] YEAR COMPLETED	[23] PURPOSES	[24] STRUCTURAL HEIGHT (ft)	[25] HYDRAULIC HEIGHT (ft)	[26] IMPOUNDING CAPACITIES MAXIMUM (acre – ft.)	[27] IMPOUNDING CAPACITIES NORMAL (acre – ft.)	[27A] CORPS ENGR. DIST.	[27B] OWN.	[27C] FED. R.	[27D] PRV/FED	[27E] SCS A.	[27F] VERIFICATION DATE DA	MO	YR	BLANK
RE	1950S		41	41	2444	1995	NED	N	N	N	N				

[28]

REMARKS

REMARKS

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[1]

PART II – INVENTORY OF DAMS IN THE UNITED STATES

(PURSUANT TO PUBLIC LAW 92-367)

See reverse side for instructions.

STATE	IDENTITY NUMBER
1 2	3 4 5 6 7
ME	0 0 1 9 4

[29] [30] [31] [32] [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] [45]

STATISTICS	D/S HAZ	CREST LENGTH (ft)	SPILLWAY TYPE	SPILLWAY WIDTH (ft)	SPILLWAY MAXIMUM DISCHARGE (cfs)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LOCKS LENGTH (ft)	LOCKS WIDTH (ft)	LOCKS LENGTH (ft)	LOCKS WIDTH (ft)	LOCKS LENGTH (ft)	LOCKS WIDTH (ft)	LOCKS LENGTH (ft)	LOCKS WIDTH (ft)	BLANK
8	9	10 11 12 13	14 15 16	17 18	19 20 21 22 23 24 25	26 27 28 29 30 31 32 33 34	35 36 37 38 39 40	41 42 43 44 45 46	47	48 49 50 51	52 53 54	55 56 57 58	59 60 61	62 63 64 65	66 67 68	69 70 71 72	73 74 75	76 77 78 79	80
	2	1045	C	70	2530														5

[46] [47] [48]

MISC. DATA	OWNER	ENGINEERING BY	CONSTRUCTION BY	
8	9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55	56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75	76 77 78 79	80
	KITTERY WATER DISTRICT	WHITMAN & HØWARD ENG	LANDERS & GRIFFIN, INC		6

[49] [50] [51] [52]

MISC. DATA (Continued)	REGULATORY AGENCY: DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE	
8	9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25	26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43	44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61	62 63 64 65 66 67 68 69 70 71 72 73 74 75	76 77 78 79	80
	NØNE	NØNE	NØNE	NØNE		7

[53] [54] [55]

MISC. DATA (Continued)	INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION	
8	9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40	41 42	43 44	45 46	47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75	76 77 78 79	80
	HALEY & ALDRICH, INC.	02	NØV	79	PUBLIC LAW 92-367		8

[56]

REMARKS	REMARKS	
8	9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75	76 77 78 79	80
			9

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(1)

PART III - INVENTORY OF DAMS IN THE UNITED STATES
SUPPLEMENTARY DATA

STATE	IDENTITY NUMBER
ME	00194

LOCATION

A-1 TOWN	A-2 NED PERMIT NO.	A-3 STATE NUMBER	A-4 F.E.R.C. NO.	A-5 U.S.G.S. SHEET
YORK		5124		YORK HARBOR ME

DRAINAGE CHARACTERISTICS

B-1 DRAINAGE AREA SQ MI	B-2 FLOW DATA MIN. C.F.S.	B-3 FLOW DATA AVE. C.F.S.	B-4 FLOW DATA MAX. C.F.S.	B-5 CREST ELEV. M.S.L.	B-6 ABUT. ELEV. M.S.L.	B-7 USABLE STORAGE ACRE FEET	B-8 RESERVOIR AREA ACRES	B-9 FLASH BOARD HT. FEET	B-10 OUTLET CONDUITS NO.	B-11 OUTLET CONDUITS SIZE	B-12 INVERT ELEV. M.S.L.
2				75	81		120	20	2	16 IN DIA	42

POWER DATA

C-1 GENERATION UNITS INSTALLED NO.	C-1 GENERATION UNITS INSTALLED CAP K.W.	C-1 GENERATION UNITS PLANNED NO	C-1 GENERATION UNITS PLANNED CAP K.W.	C-2 AVERAGE ANNUAL GENERATION K.W.H.	C-3 LAST GEN YEAR	C-4 RETIRED YEAR	C-5 FORMER USE	C-6 CAPACITY FACTOR

NED FORM 1 JAN 79 80(TEST)